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Teschmacher, J. E., Esq, Boston.
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ERRATA.

Page 47, line 15 from top, for *particular* read "particle."

" 48, " 12 " for $+ \pi r$ read "$\times \pi r$."

" 58, " 8 " for *intervals* read "interval."

" 117, " 6 " for *longer than air* read "longer than for air."

" 156, " 3 " for *wan-* read "want."

" 156, " 8 " for *centre* read "central."

" 167, bottom line, for *I have found*, etc., read "whose name I have found," etc.

" 170, line 25 from top, before PISA BICORNA insert †.

OBJECTS AND RULES OF THE ASSOCIATION.

OBJECTS.

The Society shall be called "The American Association for the Advancement of Science." The objects of the Association are, by periodical and migratory meetings, to promote intercourse between those who are cultivating science in different parts of the United States; to give a stronger and more general impulse, and a more systematic direction to scientific research in our country; and to procure for the labors of scientific men, increased facilities and a wider usefulness.

RULES.

MEMBERS.

Rule 1. Those persons, whose names have already been enrolled in the published proceedings of the Association, and all those who have been invited to attend the meetings, shall be considered members on subscribing to these rules.

Rule 2. Members of Scientific societies, or learned bodies, having in view any of the objects of this Society, and publishing transactions, shall likewise be considered members on subscribing to these rules.

Rule 3. Collegiate Professors of Natural History, Physics, Chemistry, Mathematics, and Political Economy, and of the theoretical and applied Sciences generally; also Civil Engineers and Architects who have been employed in the construction or superintendence of public works, may become members on subscribing to these rules.

Rule 4. Persons not embraced in the above provisions, may become members of the Association, upon nomination by the Standing Committee, and by a majority of the members present.

OFFICERS.

Rule 5. The officers of the Association shall be a President, a Secretary, and a Treasurer, who shall be elected at each Annual Meeting, for the meeting of the ensuing year.

MEETINGS.

Rule 6. The Association shall meet annually, for one week or

longer, the time and place of each meeting being determined by a vote of the Association at the previous meeting; and the arrangements for it shall be entrusted to the Officers and the Local Committee.

STANDING COMMITTEE.

RULE 7. There shall be a Standing Committee, to consist of the President, Secretary, and Treasurer of the Association, the Officers of the preceding year, the Chairman and Secretaries of the Sections, after these shall have been organized, and six other members present, who shall have attended any of the previous meetings, to be elected by ballot.

RULE 8. The Committee, whose duty it shall be to manage the general business of the Association, shall sit during the meeting, and at any time in the interval between it and the next meeting, as the interests of the Association may require. It shall also be the duty of this Committee to nominate the General Officers of the Association for the following year, and persons for admission to membership.

SECTIONS.

RULE 9. The Standing Committee shall organize the Society into Sections, permitting the number and scope of these Sections to vary, in conformity to the wishes and the scientific business of the Association.

RULE 10. It shall be the duty of the Standing Committee, if at any time, two or more Sections, induced by a deficiency of scientific communications, or by other reasons, request to be united into one; or if at any time a single Section, overloaded with business asks to be subdivided, to effect the change, and, generally, to readjust the subdivisions of the Association, whenever, upon due representation, it promises to expedite the proceedings, and advance the purposes of the meeting.

SECTIONAL COMMITTEES AND OFFICERS.

RULE 11. Each Section shall appoint its own Chairman and Secretary of the Meeting, and it shall likewise have a Standing Committee, of such size as the Section may prefer. The Secretaries of the Sections may appoint assistants, whenever, in the discharge of their duties, it becomes expedient.

RULE 12. It shall be the duty of the Standing Committee of each Section, assisted by the Chairman, to arrange and direct the proceedings in their Section, to ascertain what written and oral communications are offered, and for the better forwarding the business, to assign the

order in which these communications shall appear, and the amount of time which each shall occupy; and it shall be the duty of the Chairman to enforce these decisions of the Committee.

These Sectional Committees shall likewise recommend subjects for systematic investigation, by members willing to undertake the researches, and present their results at the next Annual Meeting.

The Committees shall likewise recommend Reports on particular topics and departments of science, to be drawn up as occasion permits, by competent persons, and presented at subsequent Annual Meetings.

REPORTS OF PROCEEDINGS.

RULE 13. Whenever practicable, the proceedings shall be reported by professional reporters or stenographers, whose reports are to be revised by the Secretaries before they appear in print.

PAPERS AND COMMUNICATIONS.

RULE 14. The author of any paper or communication shall be at liberty to retain his right of property therein, provided he declares such to be his wish before presenting it to the Society.

GENERAL AND EVENING MEETINGS.

RULE 15. At least three evenings in the week shall be reserved for General Meetings of the Association, and the Standing Committee shall appoint these and any other General Meetings which the objects and interests of the Association may call for.

These General Meetings may, when convened for that purpose, give their attention to any topics of science which would otherwise come before the Sections, and thus all the Sections may, for a longer or shorter time, reunite themselves to hear and consider any communications, or transact any business.

It shall be a part of the business of these General Meetings to receive the Address of the President of the last Annual Meeting, to hear such reports on scientific subjects as, from their general importance and interest, the Standing Committee shall select; also, to receive from the Chairmen of the Sections, abstracts of the proceedings of their respective Sections, and to listen to communications and lectures explanatory of new and important discoveries and researches in science, and new inventions and processes in the arts.

ORDER OF PROCEEDINGS IN ORGANIZING A MEETING.

RULE 16. The Association shall be organized by the President of preceding Annual Meeting: the question of the most eligible distribution of the Society into Sections, shall then occupy the attention of the Association, when, a sufficient expression of opinion being procured, the meeting may adjourn, and the Standing Committee shall immediately proceed to divide the Association into Sections, and to allot to the Sections their general places of meeting. The Sections may then organize by electing their officers, and proceed to transact scientific and other business.

LOCAL COMMITTEE.

RULE 17. The Standing Committee shall appoint a Local Committee from among members residing at or near the place of meeting, for the ensuing year; and it shall be the duty of the Local Committee, assisted by the officers, to make arrangements for the meeting.

SUBSCRIPTIONS.

RULE 18. The amount of the Annual Subscription of each member of the Association shall be one dollar, which shall entitle him to a copy of the proceedings of each meeting. The members attending an Annual Meeting shall pay, on registering their names, an additional assessment of ——— dollars. These subscriptions to be received by the Treasurer or Secretary.

ACCOUNTS.

RULE 19. The Accounts of the Association shall be audited annually, by Auditors appointed at each meeting.

ALTERATIONS OF THE CONSTITUTION.

RULE 20. No Article of this Constitution shall be altered or amended without the concurrence of three fourths of the members present, nor unless notice of the proposed amendment or alteration shall have been given at the preceding Annual Meeting.

CONTENTS.

PROCEEDINGS.

First Day, Tuesday, March 12, 1850.

In accordance with a resolution of the Association, its Third Meeting was held at Charleston, S. C., in the Hall of the Court of Equity, at 10 A. M., March 12, 1850.

The President for the year, Prof. Henry, being absent, on motion of Prof. Agassiz, the meeting was organized by calling Prof. Bache, the President elect, to the Chair. The Secretary and Treasurer also being absent, on nomination by the local Committee, Prof. Lewis R. Gibbes was appointed Secretary, Dr. P. C. Gaillard Assistant Secretary, and Dr. St. Julien Ravenel, Treasurer.

The Association then proceeded to the election of additional members for completing the Standing Committee, under the Seventh Rule, and, on motion, it was resolved to elect three to-day and three to-morrow. Dr. A. A. Gould, Dr. J. E. Holbrook, and Rev. Dr. Bachman, were elected.

Lieut. Maury moved that the division of the Association into sections be postponed until to-morrow, which motion was adopted.

The Association took a short recess to enable the Standing Committee to transact business.

At a quarter past 12, the Association re-assembled, Prof. Bache in the Chair, and received the Report of the Standing Committee.

They recommended that gentlemen presenting papers from absent members, be requested to give abstracts of those papers, and that those sent to the Local Committee be referred to Special Committees for the like purpose.

The following gentlemen, nominated by the Standing Committee, were elected Members of the Association:

Gen. W. Thompson, Greenville, S. C.; Dr. Wm. L. Jones, Athens, Geo.; R. Yeadon, Esq., Dr. F. M. Robertson, Charleston; Dr. Gibbon, Charlotte, N. C.; Hon. Mitchell King, Professor E. Geddings, Charleston; Dr. Wm. L. Moultrie, Charleston; Prof. H. R. Frost, Prof. Thos. Prioleau, Charleston; Prof. John Bellinger, Charleston; Dr. F. P. Porcher, Charleston; Dr. D. J. Cain, Charleston; Dr. T. L. Burden, Charleston; Dr. E. Horlbeck, Charleston; H. Ravenel, Esq., Charleston District; Lieut. Kurtz, U. S. A.; C. O. Boutelle, Esq., Coast Survey; C. Zimmerman, Esq., Columbia, S. C.; Dr. T. L. Ogier, Charleston; Dr. Jervey, Charleston; Dr. Wragg, Charleston; Pres. W. P. Finley, Charleston; Dr. Jos. Johnson, Charleston; J. Johnson, Esq., Charleston; E. B. White, Esq., Charleston; Edwd. Jones, Esq., Charleston; Rev. Dr. Wightman, Charleston; Dr. Mathew A. Ward, Athens, Geo.; Prof. C. F. McKay, Athens, Geo.; Prof. Harvey, Dublin University; Dr. Sandford Barker, Rev. G. C. Shepard, Charleston; Prof. Porcher, Charleston; Rev. Dr. Sommers, Ogden Hammond, Esq., Professor Hawkesworth, Charleston; Dr. H. W. DeSaussure, Charleston; Capt. Parker, Charleston; H. A. DeSaussure, Esq., Charleston; Dr. Saml. Wilson, Charleston.

The programme for the day being announced, the first paper was read:

A Catalogue of the Natural Orders of Plants, inhabiting the vicinity of the Santee Canal, S. C., as represented by genera and species; with observations on the meteorological and topographical conditions of that section of Country; by H. W. Ravenel.

The subjects of the "Geography of Plants," and of their distribution over the surface of the earth, are matters of interest, not only to those who are specially engaged in botanical investigations, but also to the geologist, and all others who are interested in the observation of natural phenomena, and of the laws which govern them.

In this country, vast in territorial extent, and containing within her limits every phase of vegetation, from the dwarfish Alpine growth to the exuberant development of tropical life, time must necessarily be required for collecting together the diversified floras of such an extensive region, and for investigating the climatic, meteorological and geological conditions which affect their several localities, before the laws which govern their distribution can be established, and the "Geography of Plants" take its place in our physical history as a science.

Where the field of labor is so great, and the labourers few, attention has been hitherto confined rather to descriptive Botany—the determination and description of genera and species. This must necessarily be the first operation—the groundwork upon which any superstructure is to be raised. And, as in other departments of knowledge, so it is here; as we ascend from the special to the general, from the study of local and isolated forms, to an investigation of the laws which govern and influence their distribution over the earth, we need the aid of other and kindred departments of science to elucidate those causes, and to bring under the government of harmonious and universal laws, what would otherwise present only the appearance of discord and confusion.

Among the most obvious conditions which are supposed to affect vegetation, may be mentioned, mean annual, mean winter, and mean summer temperature, elevation above, and proximity to the ocean, humidity of the atmosphere, mean annual amount of rain, and the geological structure of the surface.

Although the time has scarcely arrived when we can collect a sufficient amount of statistical information upon these various subjects, to enable us to determine the isothermal, hygrometrical, and geological relations of distant portions of our country, assistance may be rendered to future investigators by recording the observations made in certain regions, and thus adding one link in the chain of testimony, which may be useful for future operations.

As an humble contribution towards this object, I offer to the Association the following paper upon the Flora of a particular locality, accompanied by a short sketch of the climatic, meteorological, and geological condition which may be likely to influence the growth and distribution of vegetable life.

The section of country to which I allude is in the vicinity of the Santee Canal, St. John's (Berkley) Parish, S. C. The plants have been collected mostly in the neighbourhood of Black Oak, and between that place and Cooper River, eight or ten miles South. My excursions have occasionally led me as far as the Santee Swamp, ten or twelve miles North, and some few in my catalogue have been found only at Eutaw Springs, twenty miles North-West. Probably nineteen-twentieths of the Phænogamous plants have been found within the first named limits, and with very few exceptions, all the Cryptogamia.

Latitude, about 33°. 15′., North.

Abstract of a Meteorological Journal kept by me for the four years past.

Mean Winter temperature, ...	51°49
Mean Summer temperature, ...	77°38
Mean Annual temperature, ...	64°28
Max. temperature of four years, ...	92°00
Min. temperature of four years, ...	15°00
Mean annual range of barometer, ...	1.02
Mean amount of rain in Winter, in inches, .	4.41
Mean amount of rain in Summer, in inches, .	16.04
Mean annual amount, in inches, ...	33.89
Prevailing winds in Winter, ...	N. W.
Prevailing winds in Summer, ...	S. W.

The thermometer used is Fahrenheit's, suspended in the open air, but out of the influence of reflected heat in the day, or of direct radiation at night.

I have kept no hygrometrical journal, and cannot therefore furnish any accurate data, but the presence of the long moss, (Tillandsia usneoides) and Epidendrum conopseum, and a great profusion of fungous life, indicate a humid atmosphere.

Distance from the Atlantic, thirty to thirty five miles North-West. Easterly winds are always damp and chilly to the feelings in Winter, and generally bring rain for two or three days as they continue.

Elevation above the level of the sea, very moderate, not precisely known.

Surface of the country generally flat and level, and with but little fall in the water courses.

Beneath the tertiary drift which covers the surface, eocene fossil limestone is found at varying depths, sometimes cropping out, and seldom deeper than six to eight feet, except in the pine barrens, which form the table lands and dividing ridges of different streams. Although limestone is so near the surface, calcareous earth is never found in our soils, except those in immediate proximity with outcropping strata, or when it has been spread over the surface for a manure. In eighteen specimens of soils which I have examined, taken from different localities in the neighbourhood, I have not detected any trace of effervescence, when treated with a mineral acid.

A conspicuous feature in the topography of this region, is the number of large springs breaking out from fissures in the subterranean limestone.

These form perpetually running streams, and from the proximity of the impervious stratum to the surface on the level grounds, large swamps of black alluvial mould, border their courses, covered, in the virgin state, with the large cypress (Taxodium distichum) water-oaks, ash, maple, and willow, (Salix nigra.) These streams are tributaries of Cooper river. On the highlands bordering these swamps, (where the best cotton lands are found) hickories, dog-wood, (Cornus florida) oaks, &c., constitute the principal vegetation. The pine barrens, which form the table lands between contiguous water courses; and, of course, the most highly elevated, when the surface is undulating, are dry, warm, and sandy—the long leaved pine, (P. palustris) and some of the scrub oaks, (Q. catesbaei, and Q. nigra) constituting the forest growth. As the surface becomes more level, and the rain-water finds no means of escape, the soil becomes cold and wet, the pinus serotina takes the place of the other, and the vegetation becomes altogether different. Pinus glaber, Myrica caroliniensis, and various species of Andropogon, cover the surface, whilst the red bay, (Gordonia lasianthus) Magnolia glauca, and Smilax lanceolata, form in the lower places almost impenetrable thickets.

I will here simply add the names of the orders of plants, with the genera and the number of species representing each order:

Orders.	Genera.	Species.
Ranunculaceæ,	Clematis,	3
	Anemone,	1
	Hepatica,	1
	Ranunculus,	5
	Thalictrum,	1
Magnoliaceæ,	Magnolia,	2
	Liriodendron,	1
Anonaceæ,	Uvaria,	1
Menispermaceæ,	Cocculus,	1
	Menispermum,	1
Berberidaceæ,	Podophyllum,	1
Cabombaceæ,	Brasenia,	1
Ceratophyllaceæ,	Ceratophyllum,	1
Nelumbiaceæ,	Nelumbium,	1
Nymphæaceæ,	Nymphæa,	1
	Nuphar,	1
Sarraceniaceæ,	Sarracenia,	2
Papaveraceæ,	Argemone,	1
	Sanguinaria,	1

Orders.	Genera.	Species.
Cruciferæ,	Nasturtium,	1
	Cardamine,	3
	Sisymbrium,	2
	Erysimum,	1
	Draba,	1
	Senebiera,	1
	Lepidium,	1
	Capsella,	1
Polygalaceæ,	Polygala,	11
Violaceæ,	Viola,	6
Droseraceæ,	Drosera,	1
Cistaceæ,	Helianthemum,	2
	Lechea,	2
Hypericaceæ,	Hypericum,	12
	Ascyrum,	2
	Elodea,	2
Caryophyllaceæ,	Molluga,	1
	Sagina,	1
	Arenaria,	1
	Stellaria,	2
	Cerastium,	1
	Silene,	3
	Lychnis,	1
Portulaccaceæ,	Portulacca,	1
Linaceæ,	Linum,	2
Geraniaceæ,	Geranium,	2
Balsaminaceæ,	Impatiens,	2
Oxalidaceæ,	Oxalis,	3
Anacardiaceæ,	Rhus,	3
Termstroemiaceæ,	Gordonia,	1
	Stuartia,	1
Malvaceæ,	Modiola,	1
	Sida,	2
	Hibiscus,	1
	Kosteletzkya,	1
Tiliaceæ,	Tilia,	1
Meliaceæ, (ex.)	Melia,	1
Vitaceæ,	Vitis,	3
	Ampelopsis,	1
Aceraceæ,	Acer,	1
	Negundo,	1
Hippocastanaceæ,	Æsculus,	1

Orders.	Genera.	Species.
Celastraceæ,	Euonymus,	1
Rhamnaceæ,	Berchemia,	1
	Ceanothus,	1
Leguminosæ,	Vicia,	3
	Phaseolus,	1
	Erythrina,	1
	Apios,	1
	Wistaria,	1
	Rhynchosia,	3
	Galactia,	4
	Clitoria,	1
	Centrosema,	1
	Amphicarpea,	1
	Robinia,	1
	Tephrosia,	3
	Indigofera,	1
	Psoralea,	1
	Amorpha,	3
	Petalostemon,	1
	Trifolium,	5
	Zornia,	1
	Stylosanthes,	1
	Desmodium,	14
	Crotalaria,	2
	Lupinus,	2
	Baptisia,	2
	Lespedeza,	5
	Cercis,	1
	Cassia,	3
	Gleditschia,	2
	Schrankia,	1
Rosaceæ,	Prunus,	2
	Cerasus,	3
	Geum,	1
	Agrimonia,	2
	Potentilla,	2
	Rubus,	3
	Rosa,	4
	Cratægus,	5
	Pyrus,	1
	Amelanchier,	1
Melastomaceæ,	Rhexia,	6
Lythraceæ,	Ammannia,	2
	Lythrum,	2

ORDERS.	GENERA.	SPECIES.
ONAGRACEÆ,	Œnothera,	3
	Gaura,	3
	Jussiæa,	1
	Ludwigia,	12
	Proserpinaca,	2
	Myriophyllum,	2
PASSIFLORACEÆ,	Passiflora,	2
CUCURBITACEÆ,	Melothria,	1
CACTACEÆ,	Opuntia,	1
CRASSULACEÆ,	Penthorum,	1
SAXIFRAGACEÆ,	Heuchera,	1
	Lepuropetalon,	1
	Decumaria,	1
	Itea,	1
HAMAMELIDACEÆ,	Hamamelis,	1
	Fothergilla,	1
UMBELLIFERÆ,	Hydrocotyle,	3
	Sanicula,	2
	Eryngium,	5
	Discopleura,	1
	Leptocaulis,	1
	Cicuta,	1
	Sium,	1
	Zizia,	1
	Thaspium,	2
	Tiedmannia,	1
	Archemora,	1
	Daucus,	2
	Chærophyllum,	1
	Archangelica,	1
ARALIACEÆ,	Aralia,	1
CORNACEÆ,	Cornus,	3
LORANTHACEÆ,	Viscum,	1
CAPRIFOLIACEÆ,	Lonicera,	1
	Sambucus,	1
	Viburnum,	4
RUBIACEÆ,	Galium,	3
	Diodia,	2
	Cephalanthus,	1
	Mitchella,	1
	Hedyotis,	4
	Mitreola,	2
	Polypremum,	1
VALERIANACEÆ,	Fedia,	1

Orders.	Genera.	Species.
Compositæ,	Vernonia,	3
	Elephantopus,	2
	Sclerolepis,	1
	Carphephorus,	1
	Liatris,	8
	Kuhnia,	1
	Eupatorium,	17
	Mikania,	1
	Conoclinum,	1
	Sericocarpus,	3
	Aster,	11
	Erigeron,	6
	Diplopappus,	1
	Boltonia,	3
	Solidago,	12
	Bigelovia,	1
	Chrysopsis,	4
	Conyza,	1
	Baccharis,	1
	Pluchea,	2
	Pterocaulon,	1
	Eclipta,	1
	Polymnia,	1
	Chrysogonum,	1
	Silphium,	3
	Ambrosia,	1
	Xanthium,	1
	Melanthera,	1
	Heliopsis,	1
	Tetragonotheca,	1
	Rudbeckia,	2
	Helianthus,	5
	Coreopsis,	10
	Bidens,	3
	Spilanthes,	1
	Verbesina,	2
	Helenium,	1
	Leptopoda,	2
	Marshallia,	1
	Maruta,	1
	Achillea,	1
	Leucanthemum,	1
	Soliva,	1
	Gnaphalium,	2
	Antennaria,	1
	Cacalia,	2
	Senecio,	2

Orders.	Genera.	Species.
Compositæ, (con.)	Arnica,	1
	Cirsium,	4
	Chaptalia,	1
	Krigia,	1
	Cynthia,	1
	Hieracium,	2
	Nabalus,	2
	Pyrrhopappus,	1
	Lactuca,	2
	Mulgedium,	1
	Sonchus,	2
Lobeliaceæ,	Lobelia,	6
Campanulaceæ,	Specularia,	1
Ericaceæ,	Vaccinium,	4
	Gaylussacia,	3
	Clethra,	1
	Lyonia,	2
	Leucothoe,	2
	Andromeda,	2
	Azalea,	2
	Cyrilla,	1
	Monotropa,	1
	Hypopitys,	1
Pyrolaceæ,	Chimaphila,	1
Lentibulariaceæ,	Utricularia,	6
	Pinguicularia,	2
Primulaceæ,	Lysimachia,	5
	Anagallis,	1
	Centunculus,	1
	Samolus,	1
Aquifoliaceæ,	Ilex,	4
	Prinos,	2
Ebenaceæ,	Diospyros,	1
	Styrax,	2
	Hopea,	1
Sapotaceæ,	Bumelia,	1
Plantaginaceæ,	Plantago,	6
Oleaceæ,	Fraxinus,	2
	Olea,	1
	Chionanthus,	1
Apocynaceæ,	Amsonia,	1
	Apocynum,	1
	Gelseminum,	1
	Forsteronia,	1

Orders.	Genera.	Species.
Asclepiadaceæ,	Asclepias,	8
	Acerates,	1
	Gonolobus,	2
Loganiaceæ,	Spigelia,	1
Gentianaceæ,	Sabbatia,	5
	Gentiana,	1
	Centaurella,	1
	Limnanthemum,	1
Bignoniaceæ,	Bignonia,	1
	Tecoma,	1
	Catalpa,	1
Polemoniaceæ,	Phlox,	4
Convolvulaceæ,	Ipomæa,	6
	Convolvulus,	1
	Stylisma,	1
	Dichondra,	1
	Cuscuta,	2
Boraginaceæ,	Heliophytum,	1
	Onosmodium,	1
Hydroleaceæ,	Hydrolea,	2
Scrophulariaceæ,	Verbascum,	2
	Linaria,	1
	Scrophularia,	1
	Chelone,	1
	Pentstemon,	2
	Mimulus,	1
	Herpestis,	3
	Hemianthus,	1
	Gratiola,	3
	Lindernia,	1
	Micranthemum,	1
	Veronica,	2
	Buchnera,	1
	Seymeria,	1
	Gerardia,	5
	Dasystoma,	3
	Pedicularis,	1
	Euchroma,	1
Orobanchaceæ,	Epiphegus,	1
	Conopholis,	1
Acanthaceæ,	Elytraria,	1
	Ruellia,	1
	Rhytiglossa,	1
Phrymaceæ,	Phryma,	1

Orders.	Genera.	Species.
Verbenaceæ,	Verbena,	2
	Callicarpa,	1
	Zapania,	1
Labiatæ,	Hyptis,	1
	Mentha,	1
	Pycnanthemum,	3
	Collinsonia,	1
	Salvia,	4
	Monarda,	1
	Nepeta,	2
	Dracocephalum,	1
	Prunella,	1
	Scutellaria,	3
	Macbridea,	1
	Marrubium,	1
	Stachys,	2
	Lamium,	1
	Teucrium,	1
	Lycopus,	2
	Trichostema,	1
Solanaceæ,	Solanum,	3
	Datura,	1
	Physalis,	3
Aristolochiaceæ,	Asarum,	2
	Aristolochia,	1
Chenopodiaceæ,	Chenopodium,	2
	Acnida,	1
Amaranthaceæ,	Amaranthus,	3
	Achyranthes,	1
Polygonaceæ,	Polygonum,	12
	Rumex,	4
Phytolaccaceæ,	Phytolacca,	1
Lauraceæ,	Laurus,	4
Santalaceæ,	Nyssa,	3
Ulmaceæ,	Ulmus,	2
	Celtis,	2
Saururaceæ,	Saururus,	1
Callitrichaceæ,	Callitriche,	1
Euphorbiaceæ,	Euphorbia,	3
	Tragia,	2
	Croton,	2
	Crotonopsis,	1
	Jatropha,	1

ORDERS.	GENERA.	SPECIES.
EUPHORBIACEÆ, (con.)	Styllingia,	1
	Phyllanthus,	1
	Acalypha,	1
JUGLANDACEÆ,	Juglans,	1
	Carya,*	6
CUPULIFERÆ,	Quercus,	16
	Fagus,	1
	Castanea,	1
MYRICACEÆ,	Myrica,	2
BETULACEÆ,	Betula,	1
	Carpinus,	1
	Alnus,	1
SALICACEÆ,	Salix,	2
	Populus,	2
BALSAMIFLUÆ,	Liquidambar,	1
PLATANACEÆ,	Platanus,	1
URTICACEÆ,	Morus,	1
	Urtica,	2
CONIFERÆ,	Pinus,	5
	Taxodium,	1
	Juniperus,	1
PALMÆ,	Sabal,	1
ARACEÆ,	Acorus,	1
	Orontium,	1
	Arisaema,	2
	Peltandra,	1
LEMNACEÆ,	Lemna,	2
	Spirodelia,	1
TYPHACEÆ,	Typha,	1
	Sparganium,	1
FLUVIATILES,	Potamogeton,	2
	Najas,	1
ALISMACEÆ,	Sagittaria,	5
ORCHIDACEÆ,	Habenaria,	8
	Epidendrum,†	1
	Cranichis,	1

* In the genus Carya, there is an interesting re-discovery of Michaux's long lost C. myristicæformis, found growing in our deep uncleared swamps, and attaining a height of from forty to fifty feet.

† EPIDENDRUM.—This is probably the extreme northern limit of this orchidaceous parasite—interesting as being the only representation in this country, of a family of plants, which prevail very extensively in tropical regions.

Orders.	Genera.	Species.
Orchidaceæ, (con.)	Triphora,	1
	Bletia,	1
	Orchis,	2
	Pogonia,	2
	Tipularia,	1
	Neottia,	2
	Malaxis,	1
	Callopogon,	1
	Listera,	1
Bromeliaceæ,	Tillandsia,	1
Burmanniaceæ,	Burmannia,	2
Hæmodoraceæ,	Lachnanthes,	1
Iridaceæ,	Iris,	3
	Sisyrinchium,	1
Amaryllidaceæ,	Amaryllis,	1
	Agave,	1
	Hypoxis,	1
	Pancratium,	1
Dioscoreaceæ,	Dioscorea,	1
Smilaceæ,	Smilax,	9
	Convallaria,	2
	Smilacina,	1
	Trillium,	1
	Uvularia,	2
Liliaceæ,	Lilium,	2
	Aletris,	2
	Medeola,	1
	Yucca,	1
	Nothoscordium,	1
Pontederiaceæ,	Pontederia,	1
Mayaceæ,	Mayaca,	1
Melanthaceæ,	Tofieldia,	1
	Chamaelirium,	1
	Amiantanthus,	2
	Zygadenus,	1
Juncaceæ,	Juncus,	10
	Luzula,	1
Commelynaceæ,	Commelyna,	3
	Tradescantia,	2
Xyridaceæ,	Xyris,	3
Eriocaulonaceæ,	Eriocaulon,	1
	Paepalanthus,	1
	Lachnocaulon,	1

Orders.	Genera.	Species.
Cyperaceæ,	Dulichium,	1
	Cyperus,	22
	Mariscus,	1
	Kyllingia,	1
	Lipocarpa,	1
	Fuirina,	1
	Eleocharis,	11
	Scirpus,	6
	Fimbristylis,	2
	Trichelostylis,	1
	Isolepis,	1
	Hemicarpha,	1
	Dichromena,	2
	Psilocarya,	1
	Rhynchospora,	20
	Ceratoschœnus,	2
	Cladium,	1
	Scleria,	5
	Hypoporum,	2
	Carex,	29
Gramineæ,	Leersia,	3
	Hydropyrum,	1
	Zizania,	1
	Alopecurus,	1
	Phalaris,	1
	Paspalum,	11
	Panicum,	22
	Oplismenus,	2
	Setaria,	1
	Cenchrus,	2
	Aulaxanthus,	2
	Digitaria,	1
	Aristida,	3
	Muhlenbergia,	2
	Cinna,	1
	Sporobolus,	3
	Agrostis,	3
	Cynodon,	1
	Eustachys,	1
	Leptochloa,	1
	Eleusine,	1
	Dactyloctenium,	1
	Ctenium,	1
	Gymnopogon,	1
	Avena,	1
	Danthonia,	2
	Uralepsis,	2

Orders.	Genera.	Species
Gramineæ, (con.)	Poa,	13
	Glyceria,	1
	Ceresia,	1
	Reboulea,	1
	Melica,	1
	Koeleria,	1
	Festuca,	2
	Uniola,	3
	Arundinaria,	1
	Elymus,	1
	Hordeum,	1
	Hemarthria,	1
	Tripsacum,	1
	Manisuris,	1
	Erianthus,	3
	Andropogon,	11
	Trichodium,	3
Characeæ,	Chara,	3
Lycopodiaceæ,	Lycopodium,	2
Filices,	Aspidium,	3
	Athyrum,	1
	Asplenium,	1
	Botrychium,	2
	Osmunda,	2
	Onoclea,	1
	Polypodium,	2
	Pteris,	1
	Woodwardia,	2
	Azolla,	1
Musci, Hepaticæ,	about	120
Lichenes,	"	175
Fungi,	"	1000
Algæ,	"	25

Recapitulation of Phænogamous Plants.

Orders.	Genera.	Species.
124	474	1075

Of Cryptogamous Plants.

Orders.		Species.
7	about	1338

As the above paper is intended to exhibit all the conditions which are supposed to affect vegetation, and also the amount and diversity of forms which may be found in a given locality, it is proper to state

that of the Phænogamous division, nearly all the species which exist here are enumerated. My search has been diligent, and those yet undetected are probably very few. Of Cryptogamia, most of the mosses, hepatics and lichens have also been collected. Among algæ, there are probably many of the smaller forms still undetected.

Although my attention has been chiefly directed for the last three years to the collection and examination of the fungi, I cannot doubt, from the ease with which new forms are continually added to my collection—the great number of different species which spring up in the same locality in different seasons, (their growth and propagation influenced so much by meteoric changes,)—that the present number may, in the course of time, be very easily doubled.

A large portion of the Cryptogamia of my collection are still undetermined; and, therefore, without giving the genera, I can only approximate to the number of species under each order.

The second paper,

On the numeric combinations of the rings in the formation of the regions of the body of Crustacea; by Professor AGASSIZ.

[Not received.]

The third,

On the influence arising from the discovery of the Gulf Stream upon the commerce of Charleston; by Lieut. M. F. MAURY.

LIEUT. MAURY said, that before the Gulf Stream was known to practical navigators, the course of trade between England and America was such as to make Charleston the half-way house between the mother country and the New-England States, including Pennsylvania and New-York.

At that time, the usual route of vessels bound to America, was to run down on the other side towards the Cape de Verdes, and until they got the N. E. trades, and with them to steer for America. This route brought them upon the Coast of the Southern States, where their first landfall was generally made. Then steering to the northward, they drifted along until they made the Capes of the Delaware, or other headlands to the North.

If now, as it often happened in the winter season, they were dri-

ven off the coast by snow storms and westerly gales, instead of running off into the Gulf stream, as vessels now do to thaw themselves, they stood back to Charleston, or the West Indies, where they would spend the winter, and wait until the spring before making another attempt.

It should be borne in mind that vessels then were not the sea boats, or the sailers they now are. Lieut. MAURY had the Log-book of a West India trader in 1746. Her average rate of sailing per log, was about one mile the hour.

The instruments of navigation were rude, chronometers were unknown, and lunars were impracticable, and it was no uncommon thing for vessels in those days, when crossing the Atlantic, to be out of their reckoning 5°, 6°, and even 10°. And when it was announced that a vessel might know by consulting the water thermometer, when she crossed the eastern edge of the Gulf stream, and again when she crossed the western edge, navigators likened the discovery to the drawing of blue and red streaks in the water, by which, when the mariner crossed, then he might know his longitude.

The merchants of Providence, R. I., Dr. FRANKLIN being in London, sent a petition to the Lords of the Treasury, asking that the Falmouth packets might run to Providence instead of to Boston; they maintained that though Boston and Falmouth were between Providence and London, yet that practically the two former were further apart, for they shewed that the average passage of the London traders to Providence, was fourteen days less than the packet line from Falmouth to Boston.

Dr. FRANKLIN, on being questioned as to this fact, consulted an old New-England Captain, who had been a whaler, and who informed the Doctor that the London traders to Providence were commanded for the most part by New-England fishermen, who knew how to avoid the Gulf stream, while the Falmouth packets were commanded by Englishmen who knew nothing about it.

These two drew a chart, which was published at the Tower, and the Gulf stream, as laid down there by that Yankee whaler, has been preserved upon our charts until within a few years.

At the time that Dr. FRANKLIN made it known how navigators, simply by dipping a thermometer in the water, might know when they entered, and when they cleared the Gulf stream, Charleston had more commerce than New-York, and all the New-England States put together.

This discovery changed the route across the Atlantic, shortened the passage from sixty to thirty days coming this way, and, consequently, changed the course of trade also.

Instead of calling by Charleston as they came from England, vessels went direct to the port of their destination; instead of running down to Charleston to avoid a New-England snow storm, they stood off for a few hours, until they reached the tepid waters of the Gulf stream, in the genial warmth of which the crew recovered their frosted energies, and as soon as the gale abated, they were ready for another attempt to make their haven.

In this way the northern ports became the half way house, and Charleston an outside station.

This revolution in the course of trade commenced about 1795. It worked slowly at first, but in 1816–17, it received a fresh impulse from Jeremiah Thompson, Isaac Wright, and others, who conceived the idea of establishing a line of packets between New-York and Liverpool. This was at a period when the scales of commercial ascendancy was vibrating between New-York, Boston, Philadelphia, and other places. The packet ships of the staid New-York quaker turned the balance. Though only of 300 tons burden, and sailing but once a month, they had their regular day of departure, and the merchants of Charleston, Philadelphia, etc., found it convenient to avail themselves of this regular and stated channel, for communicating with their agents in England, ordering goods, etc. Those packets went on increasing in numbers and size until now; at the present day we have them building of 2000 tons, sailing every day, and running between New-York and every fifth-rate sea-port town in the United States, and to many foreign ports.

Thus an impulse was given to the prosperity of New-York; one enterprize begat another, until that city became the great commercial emporium and centre of exchange of the new world; and all these results are traceable to the use of the water-thermometer at sea.

Other causes, doubtless, have operated to take away from Charleston her relative commercial importance—but the primary cause was that discovery which removed Charleston from the way-side of commerce with Europe, and which placed her on the out-skirts of the great commercial thoroughfares, and away from the situation which she occupied.

In consequence of the improvement since made in navigation, ship building, etc., Lieut. Maury remarked that a ship could now go from

New-York to England, and back in less time than when Charleston was the half-way house, she could get to Charleston from London.

He therefore submitted whether this fact were not sufficient to turn the scales of commerce, and he claimed the fact to be due to the influence of the Gulf stream upon the course of trade, and the water-thermometer was the key to it all.

The fourth paper, was entitled

Observations on a remarkable exudation of Ice from the Stems of Vegetables, and on a singular protrusion of Icy columns from certain kinds of Earth during frosty weather; by JOHN LE CONTE, M.D., *Professor of Natural Philosophy and Chemistry, in the University of Georgia.*

IT is certainly a remarkable circumstance, that phenomena so striking as those forming the subject of this paper, have received so little attention from philosophers; and it is, perhaps, still more singular, that, hitherto, no attempts have been made at their explanation. STEPHEN ELLIOTT, in his "Sketch of the Botany of South-Carolina and Georgia," published in 1824, notices a remarkable protrusion of crystaline fibres of ice from the stems of the Conyza bifrons, (Vol. 2. p. 322.) SIR JOHN F. W. HERSCHEL published a short notice of a similar exudation of icy fringes occurring around thistle-stalks, and stumps of heliotropes, in the London and Edinburgh Philosophical Magazine, for 1833, p. 110, (3d Series, vol. 2, p. 110.) Professor S. P. RIGAUD, of Oxford, notices the occurrence of an analogous phenomenon on a recently built stone wall, in the succeeding number of the same journal, (3d Series, vol. 2, p. 190–1833.) As far as my researches extend, the above-mentioned notices—all of them very brief and imperfect—embrace all the observations hitherto made on these remarkable phenomena. Even the natural speculative tendency has been held in check by the extreme paucity of facts and observations; so that no explanation of them has been advanced.

For many years, my attention has been drawn to the remarkable deposition of ice around the stalks of certain plants, as well as to analagous phenomena exhibited by certain kinds of soil. During a visit to the sea-coast of Georgia, in the months of November and December, 1848, I had a very favorable opportunity of studying the phenomena as exhibited in vegetables. The plants in which I have

observed it, are two species of the genus *Pluchea* of Decandolle, or Conyza of the older botanists, viz: *Pluchea bifrons*, and *P. camphorata*. It is more common and conspicuous in the former species than the latter. Both of these plants grow abundantly in wet soils, around ponds, and along the road-side ditches, in the low country of Carolina and Georgia. The root is perennial, but the stem is annual and herbaceous.

The exudations of ice are most abundant and striking during the first clear frosty weather in November and December. At this period the earth is warm, and the serenity of the atmosphere is so favorable to radiation, that there is a remarkable difference between the temperature of the day and night. When the temperature sinks, towards daylight, to about 30° or 28° of Fahrenheit, or even lower, the surface of the ground is totally devoid of the slightest incrusting film of frozen earth, while hoar-frost is deposited in such profusion on all dead vegetable matter, as to resemble a slight fall of snow. Under such circumstances, the traveller who passes along the level roads of this region soon after sunrise, cannot fail to be struck with the remarkable accumulations of voluminous friable masses of semi-pellucid ice around the foot-stalks of the *Pluchea*, which grow along the road-side ditches. At a distance they present an appearance resembling locks of cotton-wool, varying from four to five inches in diameter, placed around the roots of the plants; and when numerous, the effect is striking and beautiful.

In relation to the exudation of ice from the stems of vegetables, the description and delineation given by Sir JOHN HERSCHEL are so clear and faithful, and accord so exactly with the results of my own observations, that I prefer using the language of that justly distinguished philosopher, whenever it suits my purpose. The engraving which accompanies his paper represents the appearance presented very accurately. My observations appear to establish the following facts in relation to this phenomenon:

1. The depositions of ice are entirely confined to the immediate neighborhood of the roots of the plants, the upper parts of the tall unbroken stalks being quite free from them. They frequently commence two or three inches from the ground, and extend from three to four inches along the axis of the stem. (*Fig. A.*) It is proper to state that, at this season, the stalks are dead, and quite dry to within about six inches of the earth, below which they are generally green and succulent. The plant has a large and porous pith, which

is always saturated with moisture, as high as six or seven inches from the base of the stem.

A

2. The ice emanates in a kind of riband, or frill-shaped wavy friable semi-pellucid excrescence, "as if protruded in a soft state from the stem, from longitudinal fissures in its sides." (*Fig. B.*) As Sir JOHN HERSCHEL remarks, "The structure of the ribands is fibrous, like that of the fibrous variety of gypsum, presenting a glassy silky wavy surface; the direction of the fibres being at right angles to the stem, or horrizontal." According to my observations, the number of ribands vary from one to five. All of them issue from the stem in vertical or longitudinal lines, which are not always symmetrically disposed around the axis. Judging from the the engraving given by Sir JOHN HERSCHEL, the *Pluchea* exhibits the phenomenon much more conspicuously and beautifully than the stumps of heliotropes observed by him. I have frequently observed the icy excrescences to exceed five inches in length; and when thus elongated, they are usually curled; often so much so as to bring the remote extremity of the frill nearly in contact with its line of attachment to the stalk.

B

3. "Although," as Sir JOHN HERSCHEL correctly observes, "the icy sheets appeared to have been protruded from the interior of the stem, yet, on examination, they were found to terminate sharply at its surface, adhering to it so lightly as to render it impossible to handle

a specimen without detaching them, and in no instance connected with any formation of ice within; on the contrary, the majority of the stems were sound and solid, and many of them still green when cut. The point of attachment of the ice was, however, always on the surface of the *wood*, beneath the outer bark or epidermis, which the frozen sheets had, in every instance, stripped off, and forced out to a distance. Where the fringes were large and well developed, the bark had quite fallen off; but in those cases where it adhered more strongly, it seemed to have prevented their free expansion; and in such instances the stem presented the singular appearance of a thick massive coating of ice interposed between the wood and its integument, which was swollen and rifted." (*Fig. C.*) To the foregoing very accurate description, I have only to add, that according to my observations on the Pluchea, when the frost is quite *severe*, the icy sheets were often "connected with the formation of ice within," in fact, were continuous with the frozen pith; but under such circumstances, the wood was always rifted longitudinally, and the process of protrusion seemed to have been completely checked at the part of the stem in which this took place. Indeed, the phenomenon was seldom exhibited in its most perfect and beautiful form, when the wood was split. It is obvious, therefore, that in these instances, the frigorific action was too intense to permit the phenomena to be developed in a normal manner.


C

4. The phenomenon took place in the *same plant*, during several consecutive nights; and when the wood was *not* rifted, frequently from the *same portion* of the stalk. When the wood *was* split, however, the deposition of ice occurred lower down the stem, at a part which was unaffected by the frost of the previous night. (*Fig. A.*) The stalks thus became completely rifted by a succession of severe nights, from the height of six or seven inches down to the ground. This is unquestionably one of the reasons why these exudations of ice are seldom observed after the middle of winter, for the stalks are usually destroyed before this period.

5. The stems which had been cut off within three or four inches of the ground, exhibited the phenomenon as conspicuously as those which were left untouched. The icy sheets *never* issued from the *cut surface*, but *always* from *longitudinal lines*, commencing somewhat below it, and extending towards the root. (*Fig. B.*) Plants which were torn up and transplanted in a vase of moist earth, in a flower-garden, exhibited the same phenomenon, although much less strikingly than when left *in situ.*

"The appearances above described," to use the language of Sir JOHN HERSCHEL, "are quite at variance with any idea of the deposition of these icy fringes from the store of aqueous vapor in the general atmosphere, in the manner of hoar-frost; and the only quarter to which we can look for their origin is in the plant itself, or in the comparatively warm earth beneath, to whose exhalations the decaying stems may form a kind of chimney."

The additional facts which my observations establish—particularly in relation to the recurrence of the phenomenon on the same portion of the stalk during several successive frosts, even after it had been cut off—appear to be irreconcilable with the idea that the physiological functions of the plant have any share in the production of it. We must, therefore, look to the moist earth for the large supply of water necessary for the development of these voluminous masses of ice. But by what force, and through what agency is it elevated and protruded?

Impressed with the idea that the phenomenon is purely *physical*—having no connection with the vitality of the stem; it seemed reasonable, that the remarkable exudation of *icy columns* from certain kinds of earth, which long attracted my attention, might be referred to a similar cause. Considerations of this character induced me to study the latter phenomenon more carefully. During the winters of 1848–49, and 1849–50, abundant opportunities occurred of examining the phenomenon, under the most diversified circumstances; the soil in this neighborhood* being peculiarly adapted to its development.

The following facts seem to be established by my observations:

1. The phenomenon occurs most strikingly when a warm rainy period terminates in clear freezing weather, with the wind from the West or North-West. It is more or less distinctly developed at all temperatures below 30° Fahrenheit. When, however, the thermometer was as high as this at sunrise, it was exhibited only in situations most favorable to radiation. It frequently appears during several consecutive

* Athens, Ga.

nights after a rain, but usually, when the temperature remains nearly constant—with decreasing conspicuousness. This obviously arises from the diminution of moisture: in situations which are persistently wet, it is always developed in proportion to the depression of temperature.

2. It takes place in soils that are rather firm, but not very compact. For example: the phenomenon is beautifully exhibited along the sides of the water worn ravines, which furrow the declivities of the firm red clay-hills, of this primitive region, as well as along the cuts or ditches by the road-side. This clay seems to be formed by the decomposition, *in situ*, of hornblendic gneiss and mica-schist. This soil presents the same phenomenon when thrown up and lying on the surface, provided it is not trodden down and rendered too compact. For this reason it never appears on the well-beaten highways, although it is seen abundantly along their margins. The influence of compactness of soil, is strikingly illustrated by the fact, that the protrusion of the icy columns will frequently occur around the margins and along the middle cleft of a track of a cloven-footed animal, while none were found on the portions where the clay had undergone compression. The clods found at the bottom of the ravines and along the margins of the brooks, generally afford beautiful manifestations of the phenomenon, under proper circumstances. It is seldom, if ever, observed in rich mellow alluvial soils abounding in vegetable matter.

3. The general appearance of the phenomenon is that of a vast number of filaments of ice, forming in their aggregation fibrous columns resembling bundles of spun glass, emanating at right angles to the surface, as if protruded in a semi-fluid state from an infinitude of capillary tubes in the ground. The structure of the columns is distinctly fibrous, presenting a fine silky, wavy, silvery surface, analogous to that of the fibrous variety of gypsum. They exhibit various degrees of diaphaneity, apparently depending on the purity of the water, as well as on the state of aggregation of the icy filaments; being in some situations almost perfectly transparent, and in others scarcely semi-pellucid. Sometimes the fibres composing the columns are readily separable,—at other times, they are, as it were, fused together. When examined by transmitted light, *transverse striæ* are observed to cross the filaments at intervals varying from one-tenth to one-thirtieth of an inch. A thin stratum or crust of loose frozen earth is frequently detached and elevated on the summits of the columns, often forming a continuous roof-like covering to the soil

beneath, extending over many square yards: at other times appearing in separate and isolated flat caps of variable size. The columns are not always uniformly distributed over the surface of the ground, but frequently exhibit considerable intervals of unfrozen soil between them. When the exudation takes place around the margins of a circumscribed depression containing water—like that left by the foot of a horse—it appears to draw up the water from the cavity, leaving an interior grotto lined with fantastic groups of icicles.

The icy columns vary in length, from one to three, four, and even five inches, according to the favorableness of the situation, and the intensity of the cold. They vary in size, from mere threads to prismatic bundles of one-fourth of an inch in diameter. When very long, they frequently fall over by their gravity, presenting a beautiful appearance when viewed in masses. The effect produced by walking over a surface on which the phenomenon is well-developed is very striking. The superior crust of frozen earth, and its supporting icy columns give way under the foot, which thereby sinks several inches below the apparent surface at every step. When the phenomenon occurs along the precipitous sides of the ravines and road-side cuts, the earth which has been elevated falls down to the bottom of the inclined plane as soon as the sun takes effect, leaving a fresh surface of soil exposed to the next frost; and as this exfoliation continues from night to night, when the weather is sufficiently cold, while all the earthy matter which is thus thrown down, is carried off by the first considerable fall of rain, it is sufficiently obvious that it is a powerful agent of disintegration. When the weather is not severe, it is only exhibited in situations most favorable to the production of cold. The presence of a twig or a straw on the surface of the clay, will, under these circumstances, determine the place of development of the phenomenon; and a twig will thereby be elevated above the general surface, supported by an elegant pectinated arrangement of icy columns.

4. On examination, the icy columns were found to terminate sharply at the surface of the clay, adhering so lightly as to be detached by a mere touch of the finger, and *scarcely ever* connected with any formation of ice below, in fact *never*, under the circumstances most favorable to the development of the phenomenon. On the contrary, in the majority of cases, the soil from which they protruded *was not frozen* in the slightest degree, even during our severest weather, and when the earth in other situations was completely incrusted. This point

was carefully examined, early in the morning, on the 11th of January, 1849, when the thermometer was at 14° of Fahrenheit, at sunrise, again on the 17th of February, when it was 12°, and again on the 19th of the same month, when it stood as low as 5°—a most extraordinary degree of cold for this latitude—(34 North Lat.) These observations were carefully repeated on the mornings of the 4th, 5th, 6th, and 7th of February, 1850, when the temperature was respectively 16°, 14°, 18°, and 23° of Fahrenheit's scale, at sunrise. On *none* of these occasions was the ground—where the icy columns were developed in profusion—*frozen* in the slightest degree. The afternoon of February 4th, 1850, afforded me the rare opportunity of observing the phenomenon in the very act of development. It took place on an eastern exposure, at 5 1-2 P. M., when the temperature was 28°, Fahrenheit. As the day was very cold, the icy columns of the previous night—which were about three inches in length—had been only partially melted, in this protected situation, by the influence of the mid-day sun. At the time the observation was made, these columns were found to be elevated about *one inch*, by the recently protroded ice. The line of demarkation between the *old* and *new* ice-formation was perfectly distinct; the lower portions of the *former* having been remarkably attenuated by the process of liquefaction during the heat of the day. In this case it was obvious, that the evolution of the phenomenon during the previous night and morning, had been temporarily checked by the solar heat, but was resumed as soon as that influence was withdrawn. The state of the soil was carefully examined; for it seemed to be almost certain, that the process of formation must have been going on, under the eye, at the time that the observations were made. The subjacent clay was found to be moist and unfrozen, the icy columns separated from it with the slightest touch, and *were not* connected with any formation of ice below. As already intimated, in less favorable situations, when the frigorific action was intense, the soil on which the columns rested, sometimes became incrusted with ice, after the protrusion had commenced; but this was invariably attended with a complete arrestation of the process: indeed under such circumstances it was obvious that there had been an imperfect development of the phenomenon. In these cases, a stratum of frozen earth was found adhering to the base of the columns, while continuous icy threads were observed to transpierce this crust perpendicularly, and occasionally to extend into minute apertures in the unfrozen soil beneath it. As

already remarked, in more favourable situations, the ground beneath was never frozen; but on cautiously removing the icy columns, the moist clay was found to present a very porous appearance, as if perforated by a multitude of holes or spiracles, corresponding in position with the bundles of thread-like ice, and which were frequently of sufficient size to be quite obvious to the unassisted eye.

Having thus described, with sufficient fullness, the phenomenon attending the occurrence of exudations of icy fringes from the stems of plants, as well as the protrusion of columns of ice from certain soils, we are now prepared to offer something in explanation of them—and to attempt to rise from the mass of details to the *causes* which have given birth to these remarkable appearances. A careful examination and collation of the two series of facts above-recorded, develop so many strong points of analogy, that it is almost impossible to resist the conviction that both of the phenomena must be referred to the *same cause*. If we admit an identity of cause in the two cases, it is obvious that it must be purely *physical;* since that which relates to the production of the phenomenon on certain kinds of earth, is necessarily physical. In the remarks which follow, therefore, I shall treat the question as one of physics, and shall apply them more particularly to the phenomenon exhibited by the soil: their application to the case of vegetables will be easy and obvious.

1. It is very clear, that we cannot look to the store of vapor in the general atmosphere for the origin of the icy columns. For not only are the appearances above-described at variance with the idea of the phenomenon being a modification of hoar-frost, but the amount of water congealed at the surface during a single night, is vastly too great to have come from this source. Moreover, the phenomenon occurs very conspicuously during our most violent and dry North-West winds; circumstances under which it would be impossible for any condensation of atmospheric vapor to take place. It is well known to meteorologists, that a rapid agitation of the lower strata of the atmosphere, totally subverts the condition which is most essential to the deposition of dew, namely: that the surface must be *colder* than the superincumbent air.

2. It cannot be occasioned by the cold contracting a superficial stratum of earth, and thus forcing up the moisture which freezes at the surface: because, this cause is utterly inadequate to furnish the large supply of fluid, which is required for the production of columns of ice, from three to five inches in length. The fact that isolated

clods lying in moist situations, frequently exhibit a protruded investment of icy columns, quite equal in volume to the mass of earth from which they issued, is obviously and palpably at variance with this idea. The phenomenon observed on the stems of plants is, likewise, manifestly inconsistent with this notion.

3. It cannot be owing to the exhalation of acqueous vapour from the comparatively warm earth beneath through spiracles, undergoing condensation and congelation at the surface, and thus protruding the columns: for the amount of evaporation from such a surface, when the temperature of the air is at 12° or 14° of Fahrenheit, is hopelessly inadequate to furnish the necessary amount of water. Frequently, during a single night, a sufficient quantity of moisture is elevated in the form of icy columns, to maintain the surface in a very wet condition, even after several days exposure to the Sun.

4. Neither can the protrusion of the columns of ice be ascribed to the mere expansion of water, during the act of freezing in the capillary tubes of the clay: for this supposition is opposed to the well-established fact, *that they are not connected with any formation of ice below.* Besides, if we assume the specific gravity of ice to be .92, as compared with water at 32° Fahrenheit, it follows that the amount of expansion that it undergoes during the process of congelation, is about 87 parts in 1000 by volumes. Granting the rigidity of the capillary tubes to be such as to admit of no transverse increment, and that the *whole* amount of cubic expansion is thereby manifested in the longitudinal extension of the column—it appears from a simple calculation, that to protrude three inches of ice, the frozen column must penetrate *about thirty-four inches* below the surface of the soil. We have already seen that the ice *does not* extend below the surface when the phenomenon is well-developed, and it is well-known that the degree of cold necessary for freezing water is never observed, in this latitude, at a greater depth than one or two inches.

5. In seeking for a cause of the elevation of the fluid, the first suggestion which presented itself to my mind, was the well-known and remarkable expansion which water undergoes before congelation commences. In this we have a *vera causa*, of sufficient universality, and acting in the *right direction* to account for the phenomenon, and yet perfectly consistent with an important *invariable concomitant* circumstance, namely: the *unfrozen* condition of the clay. But a little reflection very soon convinced me that it must play a subordinate part in the production of the phenomenon. A simple calculation is

sufficient to place the inadequacy of this cause in a striking point of view. According to the recent and very satisfactory experiments of JOULE and PLAYFAIR, the maximum density of water is at 39° .1 of Fahrenheit's scale. (*Phil. Mag.* 3d Series, vol. 30, p. 41, et seq., 1847.) The very elaborate series of experiments of Professor HALLSTRÖM show, that the *mean expansion* in volume, between the point of maximum density and the freezing point, (32° Fahrenheit) is about 412 parts in 10,000,000. (Thomson on heat, etc., p. 28, Lond. 1830.) Hence it is obvious, that if by the unyielding character of the capillary tubes, the whole of the increase of volume contributed to the elongation of the column—the length of the column of water requisite for furnishing three inches of ice through the operation of this cause, would be about 72,815 inches, or nearly 6,068 feet.* His reasoning is based upon the assumption, that the temperature of the water at the orifice of the tube is at 32°, while that at the other extremity of the column, viz: (6,068 feet below the surface,) is at 39° 1 Fahrenheit; the only supposition consistent with the absence of ice beneath. As the effects of cold penetrate but a comparatively short distance below the surface of the earth, the insufficiency of this cause is too apparent to deserve further notice.

Having thus shown the inadequacy of several presumed causes, to produce the remarkable phenomena under consideration, it is, of course, expected that we should offer some explanation of them. Before doing so, it may be well to premise, that whatever may be thought to be the proximate cause of these phenomena, all the rules of philosophizing require us to look to the *earth* for the supply of fluid, and to the influence of *cold* for the elevating force. We have seen that the effect is *invariably* connected with cold, that it *increases or diminishes* with the intensity of the frigorific influence, and that it is *proportional* to the depression of temperature, in all cases of *unimpeded* action. The whole difficulty lies, therefore, in ascertaining the *modus operandi* of this cause.

After considerable reflection, we venture to offer the following as the most probable explanation of the phenomenon. Let us suppose a portion of tolerably compact porous and warm earth saturated

* According to an extensive series of experiments made by M. DESPRETZ, the the *mean* expansion of water between the points of maximum density and freezing 482.6 parts in 10,000,000. (Vide POUILLET'S *Elements de Physique Experimentale et de Meteorologie*, 5th Ed., *Tome* 1., p. 293. Paris, 1847. This makes the required length of column, equal to about 62,163 inches, or 5,180 feet.

with moisture, to be exposed to the influence of a cold-producing cause. The soil being an indifferent conductor of heat, only a very superficial stratum would be reducedto the freezing point. As the resistance to lateral expansion is less at the surface, than it is at a sensible depth below, the effect of the first freezing would be to render the apices of the capillary tubes or pores conical or pyramidal. The sudden congelation of the water, filling the conical capillaries in the superior stratum, would produce a rapid and forcible expansion, which being resisted by the unyielding walls of the cone, would not only protrude, but *project* or *detach and throw out* the thread-like columns of ice, in the direction of *least resistance*, or perpendicular to the surface. This would leave the summits of the tubes *partially empty*—a condition essential to the development of capillary force. Under these circumstances capillary attraction would draw up warm water from beneath, which, undergoing congelation, would, in like manner, elevate the column of ice still higher; and thus the process would go on as long as the cold continued to operate on unobstructed capillaries, supplied with sufficient water from below. It will be remarked, that this explanation makes the whole process of protrusion to take place in a stratum of earth, of almost inappreciable thickness. It also presumes, that the protruding force act *paroxysmally*. Does not the *wavy striated structure* of the icy columns clearly indicate that the freezing process is *intermittent?* It is obvious, that the *unfrozen state* of the soil is maintained through the operation of two causes, to wit.: the unceasing supply of warm water from below, and the large amount of *latent heat* evolved during the continued process of congelation. These two causes appear to be fully adequate to explain this remarkable fact. The foregoing view explains why the phenomenon does not take place on hard-beaten earth, and on very loose soils: for, in the one case, the compactness of the superficial stratum not only diminishes the porosity, but renders the resistance to lateral expansion greater at the surface than it is below, and consequently interferes with the protrusion of the column of ice in the right direction: while in the other case, the openness of the soil prevents the formation of tubes possessing unyielding sides, a condition which is equally essential to the process. When the intensity of the cold is sufficiently great to freeze the soil, the process is arrested, because the capillary tubes are closed, and a resistance opposed to further protrusion. The porous appearance presented by the sub-jacent clay, when the icy columns

are removed, is, doubtless, referable to the enlargement of the orifices of the minute capillaries, caused by the sudden expansion of the successive portions of fluid, as they were frozen at the surface. If the above is the true explanation of the phenomenon, we should expect from *a priori* considerations, that, in higher latitudes, where the cold is more intense and persistent, the conditions of its manifestation would exist only during the early part of Winter, before the ground became deeply and permanently frozen; or else, only in certain favorable situations, as in the neighborhood of warm springs, and, perhaps, along the margins of unfrozen streams, where local causes preserved the soil in a proper condition. Are not facts in accordance with this view?

The foregoing explanation appears to afford a satisfactory interpretation of a very remarkable experiment recorded by Sir JOHN LESLIE, which is so nearly the counterpart of what takes place in nature, that we cannot forbear citing it on this occasion. He says, in treating of artificial congelation: "when very feeble powers of refrigeration are employed, a most singular and beautiful appearance is, in course of time, slowly produced. If a pan of porous earthen-ware, from four to six inches wide, be filled to the utmost with common water till it rise above the lips, and planted above a dish of ten or twelve inches diameter, containing a body of sulphuric acid, and then a broad round receiver placed over it; on reducing the included air to some limit between the twentieth and the fifth part of its usual density, according to the coldness of the apartment, the liquid mass will, in the space of an hour or two, become entwined with icy shoots, which gradually enlarge and acquire more solidity, but always leave the fabric loose and unfrozen below. The icy crust which covers the rim, now receiving continual accessions from beneath, rises perpendicularly by insensible degrees. From each point on the rough surface of the vessel, filaments of ice, like bundles of spun glass, are protruded, fed by the humidity conveyed through its substance, and forming in their aggregation, a fine silvery surface, analagous to that of fibrous gypsum or satin spar." (Supplement to Encyclopædia Britannica, vol. 3., Art., *Cold*, p. 258.) The same elevating cause must have been in operation during the progress of this experiment, which produces the protrusion of icy columns from the earth.*

*Since the above was written, my attention has been called to analogous phenomena, which are exhibited during the crystalization of certain salts. If a

The phenomenon manifested on certain plants is every way analogous to that relating to the protrusion of ice from certain kinds of soil, and admits of the same explanation. The porous pith furnishes a constant supply of warm water from the earth, while the wedge-shaped *medullary rays* secure the mechanical conditions necessary for the development of a projectile force in the proper direction. In proof of this, it may be remarked, that the medullary rays are very conspicuous in the Pluchea, and when the stalk is split by the freezing of the water within, the fissure is observed to follow their course. The development of the phenomenon is arrested when the pith becomes frozen, for the obvious reason, that the consequent splitting of the stem destroys the arrangement of resisting tubes. For a like reason, it is exhibited lower down the stalk when it becomes rifted; for the conditions essential to its production are there found. When the cold-producing cause is not too intense, the stalk is not frozen, for the same reason that the ground remains unfrozen under similar circumstances. The reason why the phenomenon is manifested only in certain kinds of plants, probably arises from several peculiarities in their physical condition. They must be porous to furnish an abundant supply of fluid. They must be herbaceous and annual to secure *medullary rays* of sufficient size and openness, and, it is probable that all vital action must have ceased, in order that the fluid which is elevated from the soil may be unmixed with the proper juices of the plants; a mixture which would interfere with congelation.

We conclude these observations with a few remarks on the teleological bearing of the phenomenon which we have been considering. The laws of the effect of temperature on water, are so remarkable in their adaptation to the beneficial course of things, at the earth's surface, that they have never failed to impress the student of nature with the most profound admiration of the wisdom and goodness of the Great Designer. Among these, the infinite importance of the

portion of soft and porous wood—such as the smaller roots of our common cypress—be soaked in a solution of nitrate of potash, and allowed to dry by exposure to the air, the whole surface will, in a short time, be covered with a delicate hair-like investment of crystaline fibres, extending in a direction at right angles to the surface. Sulphate of zinc, frequently manifests the same phenomenon on the porous earthenware cups of GROVE's battery. There can be little doubt that the protruding cause is the same in these cases, as that which elevates the columns of ice from the ground.

latency of heat, in the economy of nature is one of the most striking. In the phenomenon which we have had under consideration, in relation to the protrusion of icy columns from the earth, we recognize an *extension* of this law, the importance of which it is scarcely possible for us to over-estimate. By an admirable combination of the laws of expansion, and capillary attraction, a vast amount of water is brought to the surface of the soil, and there disengages its *latent heat* in the act of congelation, thereby softening the rigors of winter and preserving the roots or bulbs beneath the surface of the ground from the destructive effects of cold. Even on those portions of the soil, where the phenomenon does not manifest itself in the protrusion of columns of ice, it is extremely probable that the same law operates to a more limited extent. This seems to be proved by a fact, which must have come under the observation of every one, namely: that the amount of moisture found at the surface of the ground *after* a thaw, is vastly greater than was present *before* congelation took place. This is the case, under circumstances which are incompatible with the idea of the deposition of dew: the water must, therefore, have been elevated from the depths of the earth. The philosopher who loves to dwell on causes and effects, and to trace the deep processes of thought by which the great purposes of nature have been revealed, both in the heavens above, and in the physical condition of the earth on which he treads, will be gratified to discover in every portion of the universe, those prospective arrangements, compensations, minute adaptations, and comprehensive inter-dependencies which characterize the works of an Omniscient Architect.

The President laid before the Association a Map from T. H. ALEXANDER, Esq., presenting a sketch of the Geology of California. The paper intended to accompany the Map was not received.

A paper by Dr. S. KNEELAND, of Boston, on the characteristics of the Hindoo skull, was then read by Dr. P. C. GAILLARD, to whom it had been addressed to be presented to the Association.

Characteristics of the Hindoo Skull; by S. KNEELAND, Jr., *of Boston, Mass.*

I HAVE recently had the opportunity of examining several Hindoo skulls, and among them skulls of the four principal "castes;" their authenticity may be relied on, as they were obtained by a Hindoo

resident with great care and difficulty; the skulls usually found in collections are those of the lowest "caste," whose bodies are thrown into the sacred rivers of India. Their capacity and measurements have been carefully taken, and agree very nearly with the average stated by Dr. MORTON, in his recently published catalogue of skulls.

The most superficial examination shows that the Hindoo skull is smaller than the other varieties of the Caucasian race; and even smaller than any of the other human races, excepting perhaps the African. The average facial angle of 13 skulls 76 1-2.° The average internal capacity of the Caucasian skull is 87 cubic inches, of the Mongolian 83, of the Malay 81, of the American 80, of the African 78; of the Hindoo, from thirty-one measurements by Dr. MORTON, 79.7; the addition of our thirteen measurements reduces this one-fifth of a cubic inch, making the average of 44 skulls 79.5 cubic inches.

The following are the characteristic marks of the Hindoo skull, as exhibited by these specimens:—The skull is small, the bones light, thin and transparent; shape oval, forehead narrow, low and retreating; remarkable depression at anterior inferior angels of parietal bones, and flatness of posterior inferior angles of the same bones; coronal region well developed, prominence at anterior portion of sagittal suture, flatness on posterior portion, superior portion of occipital bone prominent, inferior flat, want of symmetry between the two sides of hind head, in one case as great as in the Inca Peruvian heads; foramen magnum rather long than wide, temporal fossæ moderate, sutures very distinct and open; great development of the face; nose prominent, with small aperture; orbits large and deep, less than an inch apart; malar bones not projecting by the norma verticalis, though lines drawn from the zygomatic arches upwards, touching the temporals, are not parallel as in the typical Caucasian; incisive portion of superior maxillary bone quite prominent, with slanting direction of incisors, which diminishes the facial angle to less than 80°; downward elongation and eversion of upper alveolus, giving a deep, though wide form to the hard palate; teeth much worn, from almost exclusive vegetable food, generally sound; lower incisors frequently filed—chin prominent—considerable expansion and outward eversion of angles of lower jaw—upper jaw more prominent than the lower—greater wing of sphenoid bone narrow in temporal fossa.

It does not appear that difference of "caste" modifies the configu-

ration of the skull; the same general type seems to prevail in all classes, with occasional exceptions in point of size in the higher "castes."

The resemblance of these skulls to the Inca Peruvians and the Mound Indians, and certain customs and traditions of the present and ancient Aborigines, would lead to an interesting examination of the migrations of the Asiatic races, foreign to our present subject.

A table of the measurements is appended, the initials are the same as in Dr. MORTON's Crania Egyptiaca.

	F. A.	I. C. Cub. in.	L. D.	P. D.	F. D.	V. D.	I. M. Arch.	I. M. Line.	OC. F. Arch.	H. P.	
1st caste, - -	71°	78.0	6.7	5.0	4.2	5.0	13.8	3.8	13.7	18.6	1
2d " - -	79	92.0	7.1	5.6	4.6	5.6	15.0	4.5	15.0	20.5	2
3d " - -	74	70.0	6.8	4.9	4.3	5.0	13.7	3.9	14.1	18.8	3
4th " - -	74	68.0	6.8	4.6	4.3	4.7	13.2	3.7	13.9	18.7	4
4th " - -	74	82.0	6.8	5.4	4.6	5.1	15.0	4.2	14.4	19.8	5
4th " - -	74	72.0	6.5	5.3	4.4	4.7	15.0	4.0	13.6	18.6	6
4th " - -	70	66.5	6.6	5.1	4.2	4.4	14.0	3.6	13.5	18.7	7
4th " - -	75	86.0	7.3	5.1	4.3	5.0	15.1	4.1	15.1	20.0	8
4th " - -	80	67.5	6.8	4.7	4.1	4.8	13.7	3.8	14.0	18.5	9 SKULLS.
Average, - -	74.6	75.8	6.8	5.1	4.3	4.9	14.3	3.9	14.1	19.1.	

S. KNEELAND, Jr., *Boston.*

A paper by G. BORDEN, Jr., of Galveston, Texas, on **Meat Biscuit**, and an accompanying letter by Dr. ASHBEL SMITH, were presented by the President, to whom they had been addressed.

The following extract from Dr. SMITH's letter will explain the mode of preparation, and set forth the value and uses of the Meat Biscuit. No specimen of the article was received by the Association, to enable them to pronounce any judgment in the matter.

"I have examined with careful attention, and have several times eaten of the soup made of the meat biscuit—but, before speaking further of its uses, I will briefly allude to the manner of preparing the biscuit in question. The nutritive portions of the beef, or other meat, immediately on its being slaughtered, are, by long boiling, separated from the bones and fibrous and cartilaginous matters: the water holding the nutritious matters in solution is evaporated to a considerable degree of spissitude—this is then made into a dough with firm wheaten flour, the dough rolled and cut into the form of biscuits, is then desiccated, or baked in an oven at a moderate heat. The cooking, both of the flour and the animal food is thus complete. The

meat biscuits thus prepared have the appearance and firmness of the nicest crackers or navy bread, being as dry, and breaking or pulverising as readily as the most carefully made table crackers. It is preserved in the form of biscuit, or reduced to a coarse flour or meal. It is best kept in tin cases hermetically soldered up; the exclusion of air is not important, humidity alone is to be guarded against. I have seen some of the biscuit perfectly fresh and sound that have been hanging in sacks since last July in Mr. BORDEN's kitchen: and it is to be borne in mind, that in this climate articles contract moisture and moulder promptly, unless kept dry by artificial heat.

"For making soup of the meat biscuit, a batter is first made of the pulverized biscuit and cold water—this is stirred into boiling water—the boiling is continued some ten or twenty minutes—salt, pepper, and other condiments are added to suit the taste, and the soup is ready for the table. I have eaten the soup several times,—it has the fresh, *lively*, *clean*, and thoroughly done or cooked flavor that used to form the charm of the soups of the Rocher de Cancale. It is perfectly free from that vapid unctuous stale taste which characterizes all prepared soups I have hitherto tried at sea and elsewhere. Those chemical changes in food which, in common language, we denominate *cooking*, have been perfectly effected in Mr. BORDEN's biscuit by the long continued boiling at first, and the subsequent baking or roasting. The soup prepared of it is thus ready to be absorbed into the system without loss, and without tedious digestion in the alimentary canal, and is in the highest degree nutritious and invigorating. It is to be noted, moreover, that the meat biscuit is manufactured without salt, pepper, or any condiment or chemical antiseptic whatever: thus the *freshness* or peculiar properties inherent to recently slaughtered meat are preserved, and a simple and perfect guarantee furnished of the goodness of any particular parcel. To the soup made of Mr. BORDEN's biscuit, as already intimated, salt and the various condiments used in soups may be added to suit the taste; also, toasted bread. vegetables, etc. etc., as circumstances permit and fancy suggests, until the varied catalogue of the *potages* of the restaurateurs may be rivalled.

"The different portable soups and prepared meats for long voyages, which I have seen, answer only imperfectly the ends for which they have been designed. Being prepared more or less with condiments, these meats differ from freshly slaughtered animal food; they contain fibrous and indigestible portions, being more or less liquid in form,

they are inconvenient to carry, and besides, thus necessitate the transportation of useless bulk. The meats put up for long voyages, in the manner just alluded to, are not wholly freed from fatty matters: these undergoing slight chemical changes in time, impair both the taste and the quality of the food, into which they enter; nor are these meats so completely cooked as by Mr. BORDEN's double process of boiling and baking.

"I might here insist on the very great conveniences of Mr. B.'s meat biscuit, arising from its dryness. For long voyages, it is best preserved in soldered tin cases or tight casks; but it may be carried in sacks, suspended from one's saddle bow, for weeks or months, over the prairies, or through the desert, without risk of spoiling, using care to keep it dry; and when a case or cask is opened, it may be economised for days or weeks, according to circumstances; whereas, the liquid portable soups and prepared meats must be at once eaten, or they soon spoil, especially in damp or hot weather.

"As no condiments nor chemical preparations enter into the meat biscuit, it retains, unchanged and unimpaired, all its qualities of freshly-slaughtered meat; and, as already intimated, furnishes its own evidence and guarantee of soundness at the time of using.

"As the meat biscuit requires only ten to twenty minutes to be made into a hot delicious soup, with the aid of fire and water only, its advantages for family use, for hospitals, at sea, and on long journeys over land, and wherever it is desirable to prepare food promptly, must be obvious."

An invitation was received from Mrs. FREDERICK RUTLEDGE to meet at her residence on Wednesday evening, at 8 o'clock.

Adjourned to meet to-morrow, at 10 A. M.

LEWIS R. GIBBES, *Secretary.*

Second Day, Wednesday, March 13, 1850.

MORNING SESSION.

The Association was called to order by the President at 10 A. M., and the Minutes of the last meeting read by Dr. Gaillard, Assistant Secretary.

Dr. C. M. Cheves, nominated by the Standing Committee, was elected a member of the Association.

The Standing Committee determined that there should be each day an Evening Session, to commence at 6 P. M., and announced the programme for the Morning and Evening Sessions.

A letter of resignation, with explanations, from Prof. John Locke, was presented.

On motion of Prof. Agassiz, his resignation was accepted, and the letter referred to the Standing Committee.

The following Report was then presented, and read by the Secretary:

Report of the Committee on the Communication of Lieut. Maury, *upon Winds and Currents.*

The Committee of the American Association for the advancement of science, to which was referred the communication of Lieut. M. F. Maury, U. S. Navy, on the Winds and Currents of the Ocean, has had the subject under consideration, and has now the honor to submit the following report:

Through the great zeal and industry of the author of this communication, a vast amount of information has been brought to light, which had hitherto been concealed in the unknown records of sea voyages. These records taken separately, consist of individual experiences and observations, such as are necessarily of limited extent and value, and cannot by their single authority lead to any general conclusions. But combined and compared together, as has been done by Lieut. Maury, they prove to be of great importance, and promise to elicit information of the highest interest to the practical navigator, and to the man of science.

Upon a correct knowledge of the force and set of currents in the ocean, often depends not only the safety of vessels and their cargoes, but the lives of all on board; and owing to the want of this knowledge, many lives and much valuable property are annually cast away and lost at sea.

We are yet ignorant, to a certain extent, of the general laws which regulate the great currents of the ocean, and to a still greater degree are we uninformed of the nature and direction of local currents, which occurring near the land, are either very serviceable, or very dangerous to the navigator, according to the state of his information.

While also we are acquainted with the limits and direction of the most conspicuous general winds, as the trade-winds and monsoons, we have still much to learn concerning the places of meeting of these winds with each other, or with different winds, and the directions resulting from the combined action—concerning the winds that prevail chiefly, or at different seasons of the year, in what are termed the variable regions, and concerning the local winds, which owe their existence and character to the influence of neighboring lands.

We have again to be still further instructed as to the nature of meteoric storms, by which great destruction is caused upon the sea. The more we accumulate facts concerning them, the better shall we be able to discover the seat and circumstances of their origin, their variable dimensions, the course they travel, and the indications by which their approach is to be known.

Thermometrical navigation requires still to be very much improved before we can reap the full benefit which the use of this simple instrument, the thermometer, is destined to afford to the seaman.

It is now recognized as one of the easiest methods by which the mariner can ascertain his approach, either distant or near, to our coast, and discover his proximity to icebergs.

To these several branches of nautical knowledge, the researches of Lieut. MAURY have already made valuable additions, as we learn from the communication submitted to the Committee.

And, if continued, these additions must become every day more important, and lead nearer and nearer, to a correct understanding of the laws by which these phenomena, whether general or local, are governed, and of the best manner in which the navigator can profit by the facts that fall under his observation.

Every effort to increase the safety of navigation, and facilitate

the business of the sea, must command our warmest sympathies. The success that has hitherto attended the efforts of Lieut. MAURY, induces the Committee to urge upon the Association, and upon the Government, the great importance of continuing these investigations.

The Association can only lend the influence of its opinion and the encouragement of its sincere commendation.

But it is in the power of the General Government, by the use of vessels, and by other means, to furnish material assistance, and to afford substantial proof of its approbation of these researches, and the discoveries to which they have now led, and to which they will conduct hereafter.

The idea that suggested them, and the plan on which they are based, are entirely original with Lieut. MAURY.

By his zealous exertions, he has enlisted the interest and voluntary services of a large corps of observers, seamen and navigators, who have shared in his enthusiasm, and are now, under his direction, daily contributing to increase the securities of commerce, to develope the laws of our globe, and thus to advance the cause of human knowledge and improvement.

The Committee respectfully submits this Report, with an earnest recommendation that the Association give to Lieut. MAURY their cordial co-operation and support, and that a copy of this paper be transmitted to the Hon. Secretary of the Navy, and to the Chairmen of the Naval Committees of the Senate and House of Representatives of Congress.

JARED SPARKS,
LEWIS R. GIBBES,
BENJAMIN PEIRCE,
WM. C. REDFIELD,
J. INGERSOLL BOWDITCH,
ARNOLD GUYOT.

The Report was adopted and ordered to be printed with the Proceedings.

Prof. BACHE moved that when the reading of papers commence, a Chairman be appointed, as if the meeting were that of a section.

The Association then proceeded, according to resolution of yesterday, to elect three members to complete the Standing Committee. After ballot, Prof. C. U. SHEPARD, Dr. JAMES MOULTRIE, and Dr. ROBERT W. GIBBES, were announced as elected.

Lieut. M. F. MAURY was now called to the Chair, and

An abstract of a paper, by Dr. S. KNEELAND, of Boston, entitled the Manatus not a Cetacean, but a Pachyderm, was read by Dr. P. C. GAILLARD, to whom it had been addressed; the following is the paper at length:

The Manatus not a Cetacean, but a Pachyderm; by S. KNEELAND, Jr., *of Boston, Mass.*

AT a recent meeting of the Boston Society of Natural History, the President, Dr. JOHN C. WARREN, presented a fine and nearly perfect skeleton of the Manatus, of Florida; on which occasion, Prof. AGASSIZ compared its skull with that of the Mastodon and Elephant, and observed that the so-called Herbivorous Cetacea must be removed from the order Cetacea, and placed rather among the Pachydermata, of which last they are the embryonic type.

Since this, I have carefully examined other parts of the skeleton, and find many other points which confirm the above opinion; and these I now offer to the Association.

The cervical vertebræ of Cetacea are almost always more or less consolidated together, indicating comparatively little motion of the neck, either vertical or lateral. The Manatus has the short neck of the Cetacea, but there is more evident separation between the head and trunk; the cervical vertebræ are all separate, the 1st and 2d, being much the largest. CUVIER says, that the annular portion of the 3d, 4th, and 5th cervical vertebræ, is not complete; in this skeleton, all are complete. CUVIER, CARUS, and MECKEL state that the Manatus has *only* six cervical vertebræ, the seventh having a complete rib; but, if there are *only six cervical*, there are *seventeen dorsal* vertebræ, whereas CARUS and CUVIER make *but sixteen*:— the seventh cervical, at any rate, resembles the dorsal perfectly, except in size; it has no vertebral foramen; it has two articulating surfaces, for a rib, one on the body, and one on the transverse process; the rib-articulating surface on the body is only the half, the vertebra above completing the articulation; the transverse articulating surface is complete—in these two last respects, the seventh is like the other rib-bearing vertebræ. The last three cervical vertebræ in the elephant have large spinous processes, which the Manatus has not; even the seventh has only a mere rudiment—but aquatic animals have no need of them, their heads not requiring the support of a strong ligamentum nuchæ in so dense a medium as water; in Seals, these processes are comparatively

short. The atlas and axis in the Elephant are almost bifid on their upper surface; in the Manatus they have large spinous tubercles; the cervical vertebræ are pierced for the vertebral artery, even the atlas on the right side.

There are *sixteen dorsal* vertebræ in the Manatus, allowing *seven cervical.* The spinous processes are short, wide, and of uniform size on all, in which it resembles other aquatic mammalia—this number is intermediate between the Cetaceans, and the larger Pachyderms. The tranverse processes, (as in Cetaceans,) are as long as the spinous, In Cetaceans (CUVIER, Anatomie Comparee, tom. 1, p. 197) the *posterior* articular processes of the dorsals disappear after the few first ones, while the *anterior* are also soon effaced—in the Manatus, the *posterior* articular processes exist in all the dorsals, in two vertebræ below, while the anterior are seen in all the dorsals, and in six below, in which it approaches the Pachyderms. The inferior surface of the bodies of the dorsals, instead of being regularly rounded, is compressed and sharp laterally, in the Manatus; this resembles some Pachyderms, as the Horse.

As in Cetaceans, there is no definite limit between the lumbar, sacral, and caudal vertebræ. The spinous proceses gradually diminish from the last dorsal (or, 23d from the head,) to the 40th, where they, with the spinal foramen, cease. The transverse processes are very long, some six inches in length; the twenty-fifth has the largest, whence they diminish to the forty-eighth; they are flat, broad and thin; these differ from those of the terrestrial mammalia, and must, of course, be for the insertion of the powerful muscles of the tail. On the under surface of the caudal vertebræ there are two longitudinal rows of eminences, (two on each side on each body) which form a kind of groove for nerves and vessels, and for muscular attachments; but there is nothing to be compared with the *inferior* spinous processes of fishes, reptiles, and some mammalia (especially Cetaceans.)

CUVIER's table of the number of vertebræ in the Manatus gives "more than forty;" in our specimen there are certainly twenty-seven below the last dorsal, which would make a total of fifty; and there may be one or two more: he gives the Dugong 53 at least. This number is nearer the average of the Pachyderms than that of the Cetaceans, which last have more than sixty. In the Manatus, the osseous discs between the vertebral bodies seen in Cetacea, are not met with; neither the separation of the processes from the bodies.

The sternum of the Manatus is flat and wide, and the general shape of the thorax round, as in Cetacea.

In the Manatus, there are *sixteen* pairs of ribs, of which only two reach the sternum; in the Elephant there are nineteen pairs, of which six are true. In Cetacea, the *anterior* ribs articulate with only one vertebral body, while the posterior ribs articulate even only with the transverse processes—in the Manatus, all the ribs, except the last three, are articulated each to two vertebral bodies, and *all* are articulated to the transverse processes: in this it also resembles the Pachyderms. The ribs are quite cylindrical, thick, and very strong and heavy; the anterior extremity, instead of being flat is conical. The surface articulating with the transverse process is less prominent, and the angle of the rib less evident, (from the more regular curve,) than in the Pachyderms.

The *Scapula* in the Cetaceans, is broad, its dorsal border being double its height; the supra-spinous fossa very small; the spine little prominent; a large acromion and coracoid process: (CUVIER, tome 1, p. 354.) In the Manatus, it is long and narrow; the supra and infra spinous fossæ large and nearly equal; the spine quite prominent on anterior two-thirds; on posterior third, absent: acromion process two inches in length, half an inch wide, thin, projecting over glenoid cavity; the coracoid process a mere knob, half an inch from glenoid cavity. Its general shape is like the scapula of the horse.

The *humerus* somewhat resembles the human femur in its upper extremity, in its regular rounded head, well-defined neck, and trochanter-like tuberosities. Its shape is quite regular, it being very little twisted on itself—in its lower portion it more nearly resembles, both in shape and size, the humerus of the *Tapir*, than of any other Pachyderm—the lower part is not perforated above the condyles. It is wholly unlike that of the Cetaceans.

The *fore-arm* is wanting in our specimen; but, according to CUVIER, the radius and ulna are joined together above and below, otherwise like the other Mammalia. In Cetacea, they are compressed and flattened, and united by cartillage to the humerus and carpus.

The phalanges and carpus are wanting. All the bones are of a very heavy and compact structure, like ivory; very different from the light and porous bones of Cetacea.

In Cetaceans, the extent of the occipital bone is very much greater than in the Manatus: in Cetacea, the occipital condyles are almost united below, but they are widely separated in Manatus and Pachy-

derms: in Cetacea, their plane is nearly vertical, almost all of their articulating surface looking directly backwards, and none looking downwards: in the Manatus and Pachyderms, nearly half of the articulating surface is on the inferior portion of the skull, indicating much more extended motions of the skull on the atlas. The occipital foramen is much larger in proportion in the Manatus, than in Cetacea; the lateral diameter is twice the vertical. The whole basal portion of the skull is entirely unlike in the Manatus and Cetacea; the former resembles the Pachyderms. The cranical sutures are well marked, but very thick and strong, totally different from the squamous sutures of Cetacean crania. The *parietal* bones in Cetacea are separated by the whole width of the occipital bone, being only seen in the temporal fossæ; in the Manatus and Pachyderms they occupy their normal position, but they are united into a single bone. The bony falces in the interior of Cetacean crania are not seen in the Manatus. The *frontal* bones of Cetacea are almost entirely covered by the maxillary bones, which extend up, nearly to the occipital crest; in the Manatus, and in most Pachyderms, they are separated by a suture, and occupy the usual position in front of the parietals. The *temporal* bones of Cetaceans can hardly be said to form a part of the Cranium; the zygomatic processes are very unlike the strong, thick, and wide ones of the Manatus, which are almost united to the orbitar processes of the frontals. The crests for muscular insertions are stronger than in Cetaceans.

There is a remarkable *want of symmetry* in Cetacean crania, which is not noticed in the Manatus. The *nasal* bones of Cetacea are mere rudiments, and unsymmetrical, and the nasal opening is on the top of the head; in the Manatus the nasal opening is at the anterior extremity of the head—the nasal bones, though small, are in the usual position; in the great length of the nasal opening (extending above the orbits,) in its horizontal plane (being vertical in Cetacea,) and in the shortness of the nasal bones (which cover only a small portion of the nasal cavity,) the skull of the Manatus comes nearest to the Tapir, among living Pachyderms.

According to most anatomists, the Cetacea have no olfactory nerve; if they have, the sense of smell in a passage used as a blowhole for the discharge of water, cannot be very acute. The nasal passages of the Manatus do not perform a similar function; and the mobility and general appearance of the nostrils indicate a more refined sense of smell,—whether it has an olfactory nerve or not, I am

unable to say; but the perforations of the cribriform plate of the ethmoid bone are more numerous and larger than in Cetacea; and the structure of the ethmoid cells and plates, (which are wanting in Cetacea,) seem to show a considerable acuteness of smell.

The maxillary and intermaxillary bones, prolonged into a snout armed with conical teeth in Cetacea, are wholly unlike the same bones in the Manatus; the whole shape of the cranium and face is as unlike as in any other two orders of mammalia. The Manatus (in the adult) has no incisors, or other teeth at the anterior portion of the jaw; the molars resemble, according to Mr. OWEN, the teeth of some of the fossil tapiroid Pachydermata. In his British Fossil Mammals and Birds, 1846, Mr. OWEN alludes to the opinion (now known to be incorrect) that the Dinotherium, or gigantic Tapir of CUVIER, was a Herbivorous Cetacean, from the character of the teeth; it is now considered a true Pachyderm. In speaking of Lophiodon, (p. 312,) he says the teeth of many other Mammalia resemble those of the Tapir; and among these the Manatus, in having two principal transverse ridges to the molars, though these ridges present some differences. In the Annals du Museum d'Histoire, Naturelle, for 1809, CUVIER says that the cheek teeth of the Manatus resemble very much those of the Tapir.

The *orbits* of the Manatus are very prominent, encircled almost completely by bone, and situated even below the upper portion of the nasal opening; according to CUVIER, in the Hippopotamus the orbit is in like manner almost entirely encircled with bone; in Cetacea, the orbits are still lower in relation to the nasal openings; they are completely covered above, (chiefly by a flat process of the frontal,) but below only by a delicate bony filament from the malar bone. The Manatus has a very large infra-orbital foramen, as the Pachydermata. At the junction of the frontal, sup. maxillary and malar bones (as it were, enclosed between two laminæ of the maxillary,) is a *lachrymal* bone, which is not found generally in Cetaceans, not even in the fœtus, (according to CUVIER.)

The lower jaw in Cetacea is light and weak compared with the Manatus; it is horizontal, having no ascending ramus, and only a trace of a coronoid process; the condyle looks *directly backward;* the two bones easily separate at the symphysis. In the Manatus, as in Pachyderms, the lower jaw is very solid; there is a strong ascending ramus and a large coronoid process; the condyle is *horizontal*, transverse and spherical; the symphysis is firmly united, though

the suture is visible—in its curved form, descending angle and symphysis, it resembles the Hippopotamus. The Manatus also differs from the Cetacea in its stomach, in the presence of a cœcum, and in the structure of the heart.

From these differences must we not remove the Manatus from Cetacea and place it among Pachydermata, where it stands in the same relation as do the Seals among the other Carnivora ?*

Prof. AGASSIZ made a few remarks on this paper, to the effect that in his opinion the classification of animals must hereafter be based on Embryology.

Prof. M. J. WILLIAMS next made a report on the following paper, by Prof. JAMES H. COFFIN, of La Fayette College, Easton, Pa.

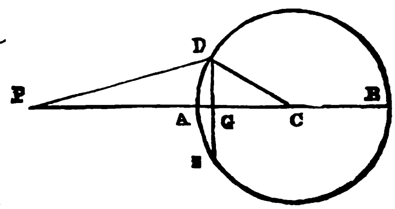
A simple demonstration of the theorem, that the attraction of a sphere upon a particular exterior to it, is the same as though all the matter of the sphere were concentrated at the centre.

THE following demonstration has an advantage over others that I have seen, both in point of simplicity and of generality. Indeed it is so simple, that I greatly suspect it is not new, though I have never met with it. In the ordinary *analytical* method, parallel planes are taken as the elements of the sphere, and the demonstration requires *two* integrations, and then applies only to spheres that are *homogeneous;* whereas this requires but *one* integration, and applies to any sphere in which the density varies as any function of the distance from the centre. NEWTON'S *geometrical* demonstration is equally general, but prolix. In this demonstration, *concentric spherical surfaces* (like the coats of an onion,) are taken as the elements of the sphere.

* NOTE.—The Society in Boston have received since the above was written, other bones of the Manatus, which enable me to call it a complete skeleton; among others, the fore-arm of both sides, the carpus of both sides, the metacarpus and phalanges of one side.

Also, the rudiments of the *pelvis*, and about 10 pairs of *inferior spinous arches* to the *coccygeal vertebræ*, both of which I said in my paper there was no indication of. They need no description, as they are accurately figured by CUVIER, in the Annales du Museum d'Histoire Naturelle, vol. 18.

Let DEB represent the sphere, C its centre, D any point in the surface, and P the attracted particle.



Draw the plane DE at right angles to PB.

Put $PC=a$, $CD=r$, and $PD=x$.

Then (by trigonometry) $PG=\frac{a^2+x^2-r^2}{2a}$, & $AG=\frac{2ar-a^2+x^2-r^2}{2a}$

And (by mensuration) the surface of the segment cut off by DE= $2AG+\pi r=\pi r\frac{2ar-a^2+x^2-r^2}{a}$

The differential of this surface$=\frac{2\pi rxdx}{a}$, which divided by PD^2 to obtain the attractive force becomes $\frac{2\pi rxdx}{ax^2}$; by resolving this force in the direction PC, it is reduced in the ratio PD: PG, and becomes $\pi r\frac{a^2+x^2-r^2}{a^2\ x^2}dx$, which is the differential of the attractive force in that direction.

The integral of this between the limits, $a=x-r$ (for the point A) and $x=a+r$ (for the point B) gives the attraction of the whole surface of the sphere$=\frac{4\pi r^2}{a^2}=\frac{\text{surface}}{a^2}=\frac{Q}{a^2}$, putting Q for the quantity of matter in surface or outer element of the sphere. Now if this matter were placed at the centre of the sphere, the expression for its attraction would obviously be $\frac{Q}{a^2}$, which shows the attraction to be the same in both cases; and the same would hold true of every concentric element of the sphere, and consequently of the whole sphere.

The third paper, was Observations on some of the applications of Natural Science to the Moral Laws of Ancient Nations; by Dr. J. H. Gibbon, of U. S. Branch Mint, Charlotte, N. C., of which the following synopsis was furnished by the author:

Synopsis of Observations on some of the applications of Natural Science to the Moral Laws of Ancient Nations.

The several inclinations—to Murder (6); to Infidelity (7); to Theft (8); to Falsehood (9); and to Covetousness (10)—which are all plainly and distinctly objected to in men, by ancient and moral laws, are visible by what we call "instincts" among other animals.

In regarding these acts when practised by other classes of creatures, we are sensible they result from natural impulse in them.

If man be directed not to imitate, or to indulge such propensities, can we not perceive that the *interdiction* recognizes similar natural impulse in us? While it assumes, with equal distinctness and simplicity, a natural power of resistance upon the same authority.

Instruction in natural acts and influences, or in natural science, was thus presented as an important duty, and the fifth command, requiring obedience of children to parents, includes in a very original manner a requisition for the instruction of children by parents.

In the first command of the moral law, the existence and attributes of a God are recognized as apparent and obvious, without explanation or argument, other than that which "the peculiar name" in the Hebrew designates and controls.

The title "I am," in our English version, including several tenses of the "Verb to be"—"I am"—"I was"—"I will be."

The strange developments which modern travel and discovery have made, in the manners and relics of natives existing before the announcement of the Hebrew Decalogue, show the evident reason of objecting, by the second command to the imaginative conceptions, which attempt to falsify the acts and the laws of "the Great Master of multitudes."

The third command appears designed to expose and correct any misapplication of "the peculiar name of God," and to have been designed to expose and reprove the deceptive practices of the ancient priesthood.

The true translation is considered to be, "thou shalt not use *the name* of the Lord *thy* God, through vanity or with deceit."

Truth was made the sole test, by which men were *taught* to judge the declarations of other men, when they employed "the name" of the Divinity.

Monday was the day appointed for the rest of oxen in India, prior to the law of the Hebrew Decalogue.

The inculcation that the Almighty had gradually formed the heavenly bodies, the earth, and the sea, is used as an argument, why we in effecting our labour, should allow to all, the instruments of such action, a discriminate period for thought, and for refreshment, and for natural rest.

The children, the servants, the cattle and "the strangers," are protected by the *same* lawgiver, who limited the movements of the planets, the seasons, and the tides!

These ten moral commands, so irregularly introduced, rule the system of our moral natures, and teach us how to regulate the excesses of the dispositions, implanted within us for the services of active life, by the proper exercise of the understanding God has also endowed us with.

In some respects this moral code was a modification of institutions then existing, while in others it exhibited a complete contrast, or exception, to the customs and belief of that time.

The main difference between the more ancient and the comparatively new decalogue, will be found in an adjustment of the parts, reformed by the same principles which led to the few original truths of moral sciences, designed to make "life" more valuable, but chiefly in distinguishing man's true, natural and moral connections with his Creator—which, in the former code, had been omitted either by intentional deception, or defective observation and knowledge.

Prof. A. D. BACHE then addressed the Association on the results of observations, on the direction and force of the wind at two of the Coast Survey Stations in the Gulf of Mexico, illustrating his subject by numerous diagrams, in which these results were traced. The substance of his remarks is contained in the following:

Notes on the Results of Observations of the direction and force of the wind at the Coast Survey Stations, at Mobile Point, and at Cat Island, Gulf of Mexico, under the immediate direction of Lieut. Com. C. P. Patterson, U. S. Navy, Assistant in the Coast Survey; by Prof. A. D. BACHE, *Superintendant.*

PROF. BACHE stated that the observations, of which he was about to call attention to the results, had been made in connexion with tidal observations of U. S. Coast Survey, at Fort Morgan, Mobile

Point, and at Cat Island Light House, near the entrance of Lake Borgne.

The observations did not pretend to more than a general accuracy, the directions being estimated by a streamer upon a flag staff, by the the aid of a circle, on which the points of the compass were marked. The force was estimated on the usual nautical scale, 0 representing a calm, and 10 a tornado. The following was the table which was used in recording the *force* of the wind.

Nautical Scale.

0	denotes	Calm.
1	"	Light Breeze.
2	"	Gentle Breeze.
3	"	Moderate Breeze.
4	"	Fresh Breeze.
5	"	Strong Breeze.
6	"	Moderate Gale.
7	"	Fresh Gale.
8	"	Whole Gale.
9	"	Storm.
10	"	Hurricane.

The observations were made hourly, during both night and day.

In computing the results, the numbers expressing the force are converted into miles per hour, by the following table:

Force.	*Velocity of miles per hour.*
1	1
2	4
3	13
4	23
5	32
6	40
7	50
8	60
9	80
10	100

The number of times during which the wind was noted as blowing from a given direction, is taken as the number of hours of its duration. The duration multiplied by the velocity is taken to represent the quantity of wind blowing from any given direction. These quantities are plotted on diagrams on a scale of 400 miles to the inch, in which the distances from the circumference of a central circle

in the several directions represent the proportional quantities of air passing from a given direction. The irregular figures formed by joining the extremities of these radial lines, show by their areas the relative quantities of wind from the several points of the compass. The quantities for each month were represented from a year's observations (1848) at Cat Island, and from the mean of two years observations (commencing June 1847, ending June 1849) at Fort Morgan. The observations were made under the direction of Lieut. Comd'g. C. P. PATTERSON, U. S. N., Assistant in the Coast Survey, by Messrs. WURDEMANN and BASSETT, and reduced under the direction of the same officer. The diagrams were drawn by Messrs. DEAN and HARRISON, of the U. S. Coast Survey.

Beginning with the month of June at Fort Morgan, we have the Summer period, in which the S. W., (the sea breeze) is the prevailing wind, the South winds are nearly double the North in quantity, and the Westerly winds somewhat exceed the Easterly. July has the same general characteristics except that the South-West wind is diminished in quantity. In August, the Summer characteristic begins to give way, and the Winter or North-East wind is considerably increased in quantity, preparing for the entire change which September presents, and the characteristic increase of North and North-East winds, and the diminution of Southerly winds. October and November present the same general characteristics as September, the North-East wind diminishing in November.

December, January, and February present the same general features in the large proportion of Northerly wind passing towards East and South-East, and preparing for the large increase of South-Easterly winds, shown in March.

The S. W. wind begins to re-appear in considerable proportion in April, the North and S. E. being still greater in quantity than the S. W. In May the S. W. becomes predominant.

Dividing thus into periods, March and April would be assimilated, the prevailing winds being North and South-East.

May, June, and July, S. E., and especially S. W.; August, almost equality, as to Northward, Southward, Eastward, and Westward direction; September, October and November, North and North-East; and December, January and February, North; even in the latter, the preparation for the entrance of S. E. winds, in March, begins to appear.

The diagram, which shows the mean results for two years, exhibits

a great prevalence of Northerly wind, and of Southerly, and a deficiency in the section from West round to North. The prevalence of due North wind here, and absence of winds from West round to North, were remarked to be due at least in part to the locality especially exposed to the North wind, sweeping the length of Mobile Bay, and in a degree sheltered by the land from the North-West.

The same general features prevail, as shown by the diagram, for the results at Cat Island, in 1848, modified by the influence of locality, protected towards the S. W., and more exposed from North round to West, than the former station. The same grouping of the months in relation to the character of the winds appears.

In the whole year the same prevalence of Easterly winds over Westerly, the same great disproportion between S. E. and N. W. winds.

Prof. Bache remarked on the ease with which the results can thus be generalized by the eye, when traced on diagrams. He next instituted a comparison of these results with those obtained at the Girard College Magnetic Observatory, in 1843, where a self-registering Osler's Anemometer was used, and the results had consequently considerable precision.

The characteristics of the months, the grouping, and the general results for the year were all different.

June, July, and August form the summer period, showing a general prevalence of S. W. winds, as for May, June, and July, at Fort Morgan. September shows N. E. as the prevailing wind. October, November, December and January, unite in a North-West characteristic. February and March, and April and May, appear to form separate pairs.

The whole year shows a great prevalence of winds from West to North, just where the former stations were deficient, a preponderance of Northerly over Southerly winds, and of Westerly over Easterly, as entire a want of local equilibrium, and in the reversed directions, as were presented by the stations in the Gulf of Mexico.

Lieut. Maury made remarks on the importance of observations such as those contained in Prof. Bache's paper, and on the value of the results to the mariner.

The next paper in order was Lieut. Maury's, on the use of the Electro-Chronograph in determining the figure and density of the Earth.

On a new application of the Magnetic Telegraph.

Lieut. Maury gave an account of Dr. Locke's clock at the National Observatory, and said the use of it had suggested the idea of determining, by means of the electro-chronograph, the figure and density of the earth, the height of mountains, and differences in the density of the interior strata between the centre and surface of the earth at different places.

Professor Keith, one of the assistants at the Observatory, had, by means of two globules of mercury to each, converted two other clocks (viz: the west sidereal and the mean time clock) also into electro-chronographs. The index or a pointer to the pendulum passed through a globule of mercury at the lowest part of the arc of each vibration, and while this pointer was in transit through this globule, the circuit was complete, and the recording pen made a dot on the registering surface, which, in this case, was a fillet of paper moving at the rate of half an inch a second between two rollers, as in the case of a common Morse Register, which is generally seen in telegraph offices.

The other globule was placed in the upper part of the clock, and so situated that a little metallic pin attached to the axis of the second wheel would pass through this globule at every sixtieth second. As the circuit through this globule was the shorter, the fluid, abandoning the long one through the pendulum, would take the shorter route back, and the recording pen would thus omit to make a dot at the completion of every minute.

The registering apparatus has five pens in a row, each of which is worked by a circuit of its own, and they are so arranged that if each one of the five were to make a dot at the same instant, we should see a row of five dots across the fillet of paper and at right angles to the plane of its length.

If we suppose the mean time and sidereal clocks each to run with a rate equal to 0s.0, and their pens each in connection with the register, we shall find that the pen of the sidereal clock will make 366 dots, while that of the mean time clock is making 365 *nearly;* so that if the fillet of paper move under the pen at the rate of an inch per second, the distance between the dots of the two pens at a given second will differ from the distance between them the next second the 365th part of an inch nearly.

Lieut. Maury exhibited fillets of paper on which the two clocks

had been made to dot seconds until there was a gain of a second between them. The dots were made upon parallel lines running as closely to each other as lines can conveniently be drawn on paper. He suggested that, in order accurately to ascertain the difference of these two clocks, it was not necessary that the fillet of paper should actually move through equal spaces during every second of time, or during the whole period of a second, but that the motion should be uniform through almost infinitely small spaces, as through the 365th part of a second for instance.

Suppose, for the sake of illustration, that the sidereal clock completes its gain of a second on the mean time clock exactly at the instant of making the 365th dot of one, and the 366th dot of the other, then the interval on the fillet between the 364th dot of the one and the 365th dot of the other should be equal to the interval between the 366th dot of the one, and the 367th dot of the other. The difference between these two pairs of dots he proposed to measure by means of a powerful microscope, with a micrometer attached, observing that space could be multiplied with much more accuracy optically, than it can mechanically. Thus, suppose the microscope used should magnify but 365 times, the 365th part of an inch would then appear through the microscope as an inch to the naked eye, which part might be readily subdivided optically into hundredths, and thus give us the means of measuring with considerable accuracy the 36500 part of a second.

With such refinement in the recording and sub-division of time, the Lieutenant said, that if two experimental pendulums, nearly duplicates of each other, were freely suspended and vibrated, the one in New-Orleans, and the other near the same meridian, on the borders of the great American Lakes, for instance; and if these pendulums were further so arranged as to make and break circuit, so as to record their vibrations in Washington, with the standard clock of the National Observatory, and if, after these vibrations had been continued till one pendulum had gained a vibration upon the other, the two pendulums were reversed and vibrated for a like period; that is, if the New-Orleans pendulum were removed to the Lake Station, and that of the Lakes removed to New-Orleans, and both vibrated as before, we should, theoretically, at least, have afforded to us rare facilities for determining an arc of the meridian.

If, now, the two pendulums were placed on the same parallel of latitude, one on the Atlantic, and the other in the Mississippi valley,

for instance, and vibrated, reversed and vibrated as before, the data would be complete, *theoretically* speaking, for determining both figure and density.

Again, if one pendulum were vibrated on the mountains crossed by Magnetic Telegraph, under such circumstances as to make dots on the same fillet with another vibrating on the sea shore, or at a known elevation above the water, we should, by reversing these pendulums, and vibrating as before, have again, theoretically, the data for determining the difference between the distance of the two stations from the centre of the earth, or in other words, the height of the mountain.

Nay, if we suppose the Magnetic Telegraph to be extended to the West Coast of America—California for instance—and if two pendulumns, one on the Pacific, the other on the Atlantic, be vibrated, reversed, vibrated and recorded as before, through electro-chronograph, we shall have the arguments for determining the difference of level between the two oceans, or the difference in density between the strata, which are interposed between the centre and the circumference, on the Atlantic, and the centre and circumference on the Pacific Coast.

The influence of the moon is also felt by the free pendulum, and if the pendulum were vibrated for a given time when the influence of the moon was a maximum, and again, when it was a minimum, and in such a manner as to record its vibrations through electro-chronograph, we should derive the elements for determining the mass of the moon.

Theoretically, all this was true. The Pendulum would have different times of vibrations under all these circumstances, and would tremble to the influence of each one of these several agents, but whether the experiment could be so refined in practice as to detect the influence of these several agents, is another matter, and one as to which the Lieutenant did not, at present, intend to express an opinion.

Suffice it to say, should the means of observation be so refined as to detect such very small quantities, the wires of the Magnetic Telegraph would then become, in the hands of the Astronomer, as a tentacle, with which he may feel the centre of the earth, as a gauge with which he may measure the difference of density in its strata, and as a balance with which he may weigh the moon, and measure atmospheric accumulations.

The Director of the National Observatory further remarked that the experimeuts which he had already made in Washington, encouraged him to hope that the electro-chronographic clock might be used, not only to drive the machinery of the registering apparatus, but to drive the clock-work of the equatorial also. If by such means a certain smooth and uniform rate of motion could be obtained for telescopes equatorially mounted, practical astronomers would regard it as an improvement of much value and importance.

Prof. GIBBES observed, that during a journey last summer, through the mountainous region of Georgia, the chief object kept in view was the selection of some peak, proper for the repetition of MASKELYNE's experiment for determining the density of the earth. Though no mountain was seen which presented in combination the conditions regarded as necessary in isolation, size, and sufficient regularity of figure and structure to permit survey and computation of its mass, yet Stone Mountain in DeKalb County, Georgia, offers some advantages, which, perhaps, adapt it for the kind of observations alluded to in Lieut. MAURY's paper. It is completely isolated, no peak of similar height, or even in any degree approaching it, being within thirty or forty miles; it is completely bare of trees, except along the western ascent, and a few clumps, where soil has accumulated about loose masses of rock; it is homogeneous in structure, consisting entirely of a fine-grained granite, approaching gneiss in appearance. It is easily accessible for survey, on all sides, and of tolerably regular sub-hemispherical shape; pendulums at the summit and base, or on the opposite sides of the base, could, with but little difficulty, be brought into galvanic connection by wire. The chief defect, and it must be acknowledged that it is a great one, is want of mass, the summit being only 630 feet above the base. A rough survey and subsequent calculation might determine whether the amount of effect on the pendulum would render the experiment worth the trial. About 1200 or 1500 feet of wire would be sufficient to connect the pendulums, at summit and base, and 4000 probably more than enough to connect them, when on opposite sides of the base.

Prof. GIBBES also remarked, that the coincidence at intervals of the beats of a solar and of a sidereal chronometer, would enable us to deduce a result not directly connected with the present subject, but of sufficient interest to be mentioned here, particularly as he had never seen it remarked, though, doubtless, it must have occurred to others.

As 365 solar days are equal to about 366 sidereal days, the seconds must bear the same ratio, and if the time-keepers beat seconds, the sidereal one will gain on the solar one 1-366th of a second at each beat, and coincidences must occur at intervals of about 366 seconds, or every 6 min. 36 sec.; if the time-keepers beat half-seconds, at every 3 min. 18 sec. As the beats of the chronometers approach coincidence, the intervals between them diminishes until at a particular instant, this interval becomes inappreciable to the ear, and the coincidence appears complete. But it is only apparent, for it will last for several seconds, depending on the delicacy of the ear; and the middle of this interval of duration of apparent coincidence, is to be taken as the most probable instant of true coincidence. In his own case, this interval was 6 seconds, or at the least 5 seconds. Taking the half of the larger of these intervals, it appears that for 3 seconds before and after true coincidence, the interval between the beats is too small to be appreciable to the ear, and as in 3 seconds the sidereal chronometer gains 3-366ths or about 1-120th of a second, it follows, that the smallest interval that can be perceived by the ear, between blows, such as those given by the teeth of the balance wheel, on the pallets of the escapement, is the 1-120th of a second. The ear of others may perhaps be more delicate in this respect.

The sixth paper read, was

On the existence in some individuals of two Insensible Spots on the Retina, by Prof. Lewis R. Gibbes, *of College of Charleston*, (*S. C.*)

In 1668, Edme Mariotte, of the Academy of Sciences of Paris, pointed out the remarkable fact that rays of light falling on a particular portion of the bottom of the eye, in its normal state, do not produce the usual visual impressions. This spot, insensible to visual impressions, is always found on the inner or nasal side of the axis of vision, and, in the opinion of Mariotte, coincided with the point at which the optic nerve entered the eye. This has never been contested, I believe, nor do I now propose doing so, but I do not know that any one, from Mariotte's time to the present, has called attention to the fact of the existence of other insensible spots of a similar character, and as one of my own eyes, the right, presents this peculiarity, I desire to bring the facts before the Association.

This diagram will serve to illustrate these facts, and must be placed before the eye, at a distance from its anterior surface equal to five times the space intercepted on the horizontal line of the diagram, between the point where the vertical line cuts it and the point indicated by a mark on the right. This distance for the accompanying diagram will be about nine inches.

If, with the head erect, I close the left eye and direct the axis of vision of the right eye to the intersection of the horizontal and vertical lines of the diagram—that point being held at the proper distance already indicated—the large circular spot in the diagram, on the right of the axis of vision, and whose centre is a little below the horizontal line, becomes invisible, as was shown by MARIOTTE. This would happen in all eyes at the same distance, or nearly so, from the diagram. But, besides this, in my own case, the second spot, of an oval form, also disappears completely. This spot lies on the *left* side of the axis of vision, and above the horizontal line, of the form of an ellipse, whose axes are in the ratio of about 3 to 5, the longer axis directed towards the point where the axis of vision pierces the plane of the diagram, and the centre of the ellipse distant from that point about the length of the longer axis. The corresponding insensible portion of the eye is of course on the *right* side of the axis of vision—that is, on the *outside* of it, and below it, and of similar proportions and position. No other similar spot in that eye has been perceived, and the left eye is in the normal condition.

It is probable that there are other individuals with a similar peculiarity, though none are known to me. Such a peculiarity might long remain unperceived until attention was called to it by accident, or by the mention of its existence in others. My attention was

called to my own defect in the summer of 1841, while viewing with the telescope the system of Saturn. The sixth satellite (Titan, in Herschel's nomenclature,) was in that part of its orbit in which it appeared, in the telescope, to be below the planet and a little to the right of a vertical line passing through it. Whenever the axis of vision was directed to the satellite, the planet disappeared entirely, or its place was occupied by a cloudy light resembling that produced when its image in the eye was caused to fall on the point of entrance of the optic nerve. This apparently sudden loss of sight was not a little startling, though the planet re-appeared when vision was directed to it or to other parts of the field. I feared an attack of transient amaurosis, such as I had previously experienced once or twice, depending upon a deranged state of the digestive system, or else an attack more serious than before; but I continued in my usual state of health, nor did any further change in the condition of the eye follow. No change has since ensued. Examined frequently since that date, the eye has always presented the same condition.

Conjectures as to its cause may be made, based on the different explanations that have been given of the insensibility of the other portion of the bottom of the eye and upon the causes assigned for certain forms of amaurosis, but anatomical examination would be requisite to decide in the case.

Dr. Myddelton Michel, of Charleston, (S. C.) then read his paper, the seventh and last this morning, on the reproduction of the Opossum; the following is an abstract of his conclusions:

Researches on the Generation and Development of the Opossum.—Didelphys Virginiana. By Myddelton Michel, M.D.

These researches were confined to the determination of the seasons of rut, manner of copulation, period of gestation, condition of membranes, support of embryo during gestation and anatomy of uterine mucous membrane, parturition and transfer of young to the pouch.

Conclusions.—The period of rut extends from December to June. In domesticity the young have been met with in January, February, different periods of March, at the end of April, in the middle of May, and once as late as June.

On the morning of the 28th January, 1847, at half-past 8 o'clock,

on repairing to the cage in which were placed a male and female, the male was found in pursuit of the other, leaping upon her back, after the manner of other quadrupeds. This continued for nearly an hour, when sexual ardor being fully established, the male, embracing her with his front legs around the neck, threw her upon her right side. Both upon their right sides, the body of the male was so bent as to bring the organ of intromission (still somewhat everted) within reach of the vulva. The act lasted a few minutes; there was no prolonged attachment between the sexes, yet there are no seminal vesicles. Gestation in one experiment, lasted fourteen days and seventeen hours. On the night of the 15th of February, 1847, the pregnant female, which served for the determination of the above-mentioned fact, was found standing on her hind legs; her body was much bent, and propped up against the corner of the cage; her muzzle in immediate contact with the cloacal opening, which was red, tumefied and distended; a young appeared at the opening, and was conveyed by the mother's mouth to the pouch, or perhaps was rather licked in, as her tongue seemed busily employed within, around and about the pouch.

The young are expelled first into the vaginal cul-de-sac, in which they remain for a short time, on the contraction of which they are forced along the vaginal canals one by one; parturition is thus very much prolonged, owing to the circuitous route which the young are obliged to take, and the delay thereby occasioned between the birth of each is the object of the peculiar modification of these parts in this animal, as it affords the requisite time employed in the conveyance of the young to the pouch and their adaptation to the teat.

Ova were detected on three occasions in the uterus. On two occasions they had only reached their blastodermic evolution; the *area germinativa* existed in one case, when five ova were discovered on one side and seven on the other. These were the size of those of a rabbit at the same stage of development; they were detected in the uterus by Dr. Bachman, and are already mentioned in the proceedings of the Academy of Sciences. They consisted of a vitelline membrane and an undivided blastoderma.

The third case presented some thirteen embryos in the uteri, and these had nearly completed their development. They were easily discernible through a transparent, non-vascular chorion, deprived of any trace of chorial villosities and entirely independent of the cavity which contained them, and in a great measure concealed by

what we regard as the hypertrophied mucous membrane of the uterus. They rolled with ease out of the uterine cavity, disclosing the absence of any attachment to the walls of the uterus. The embryos were nearly four lines in length and two in breadth across the abdomen; the anterior extremities were in every particular similar to their condition in the mammary fœtus; the posterior extremities were mere clavate projections from either side. The laminæ ventrales had nearly united through the whole length, and were entirely complete in the cervical region—no branchial clefts were, therefore, present; the opened mouth exhibited a perfectly formed tongue. Eyes as they are at birth, covered by a pellucid membrane; no traces of ears. The heart was seen through the ununited walls of the thorax. There was no placenta; the chorion transparent, non-vascular, and without villosities; the entire specimen readily left the uterus. Between the incompletely united walls of the abdomen, and near the caudal extremity, proceeded a short chord of about two lines in length, composed of the stem of the allantois and the pedicle of the umbilical vesicle; both were united so closely together, and surrounded by the amnios, that it was impossible to trace the allantoic element of this short chord to the bladder, which had already its independent existence. The allantois hung pendant at the side of the embryo, with evidence of some vascularity, much smaller than the vitelline sac, and had no connection with the chorion. The umbilical vesicle was inordinately large—as large as we meet it in those embryos which present a wide abdominal opening, branchial clefts, budding extremities, and an allantois just rising as a diverticulum from the caudal extremity of the intestine.

When we take into consideration the rapidity of development in the uterus and the limited period of gestation in this animal, in all probability, in twenty-four hours these embryos would have attained the entire condition of mammary fœtuses. For so momentary an existence an ovo-uterine or placental attachment could not be required, and would be a superabundant prodigality of structure were the establishment of this condition possible in so limited a time.

The non-villous condition of the chorion of these embryos I regard as a circumstance of the greatest interest, for the villous assumption of the chorion is preparatory to a placental development, and here we meet with none of those cellular chorial offsets belonging to placental animals.

Now, these villi are the production of a vegetative cellular growth

similar to that of the structures of the embryo itself, and their existence is prior to the formation of blood-vessels, and therefore not dependent upon a placental structure. Though they subsequently form sheaths for the ramifying vessels of the allantois, their office is far more important at an earlier period, for, like vegetable cells, they are engaged in supplying the ovum with nutrition derived from the secretions of the uterine glands, and I think I may affirm they bear an inverse ratio to the development of these latter.

An examination of the uterus in these animals furnishes much that will satisfactorily explain their organization without the aid of a placenta. It is now generally conceded, not only that a mucous membrane exists in the uterus of all animals, but that it possesses a remarkable glandular character. These utricular glands under the form of tubuli, arranged side by side perpendicularly to the surface of the uterus, vary considerably in different animals; though supposed to exist only among ruminantia, I have satisfied myself of their presence in the human subject, and I believe them to exist of necessity in all animals; they have been observed in many. In none are they so enormously developed as in our opossum, as might almost have been inferred from a knowledge of their relations to the chorial villosities. Indeed, the absence of such villi in the opossum would have induced me to search for some such arrangement, had not a knowledge of the circumstance preceded my acquaintance with their ova. There is an apparent balance in the development of the *tubuli uterini* and the chorial villosities—as the latter increase the former diminish, and *vice versa.*

On opening the uteri during gestation, they are found filled with a gelatinous or mucilaginous secretion, the product of the uterine glands, which are seen waving perpendicularly from the walls of the uterus to the free surface of its lining membrane. In the midst of these *tubuli* and their secretions, it is difficult to detect the ova upon their entrance into the uterus. These delicate transparent vesicles become entirely imbedded in the mucous membrane and elude our search, or are injured before they are removed. This is an admirable provision for ova whose absorbent powers would otherwise have been singularly diminished through want of villosities, while these are no longer of use as supports to the jutting blood-vessels of an organized allantois and placenta.

This discovery has convinced me that the ova of these didelphians

possess, during the short period of their uterine changes, a rich source of nutrition, abundantly sufficient for the plastic operations of cell-life, which alone are called into requisition during the early periods of development, and with which elaborate secretion these embryos are supplied without the assistance of villi. These villi, when they exist, are an aggregate of nucleated cells, endowed, as agents of absorption, with the power of attracting the nutritive particles from the *plasma* or *cyto-blastema* into which they are plunged; but when the maternal secretory product is so abundant, and the glandular apparatus so exuberantly developed, the free surface of the cellular chorion is all-sufficient to absorb what it required no expenditure of structure to obtain, and may convey it thus to the interior of the egg, where, being in contact with the blood-vessels of the vitelline sac and allantois, themselves developed from cells, and enjoying the vital properties of cells, it may enter directly into the blood of the embryo and be assimilated to its wants. It is proper to observe that the large size of the vitelline sac offers a surface to the omphalo-mesenteric vessels which may also aid the supply of alible materials by a process dissimilar from nutrition, through means of the yolk, but presenting, perhaps, a transitional step towards that process in birds.

Such, then, is the source from whence the embryonal didelph derives that accession of materials required after the vegetative repetition of cell-birth has elaborated its various systems of organs, and it is just at the moment when a more intimate relation and energetic re-action between parent and offspring is required, for perfecting the latter, that birth takes place.

Prof. AGASSIZ said that the subject was important and interesting, and that yet fuller details were required with regard to the membranes in the fœtal state, and to the microscopic examination of the ovum.

Dr. BACHMAN said that according to his observations, the young opossums just taken from the uterus, were vigorous enough to roll themselves over on the surface of the table on which he had laid them; and, in one case, the little animal rolled to the edge of the table and fell on the floor. They also were able to exert suction by the mouth, as was proved by their drawing in some of the cotton wool in which they were laid, threads or slender rolls of which, two or three inches in length, were drawn out of their mouths.

An invitation was received from W. B. PRINGLE, Esq., to meet at his residence to-morrow, at 8 P. M.

Adjourned, on motion, at 3 P. M., to meet again in the evening, at 6 P. M.

LEWIS R. GIBBES, *Secretary.*

Second Day, Wednesday, March 13, 1850.

EVENING SESSION.

The Association met according to adjournment at 6 P. M., Prof. BACHE in the Chair.

The Standing Committee reported the programme for this evening, and also nominated the following gentlemen for membership, who were unanimously elected:—Dr. WHITRIDGE, Dr. CHARLES DAVIS, Rev. Dr. SMYTH, WILLIAM GREGG, Esq., all of Charleston, S. C.

Lieut. MAURY was called to the Chair, and the first paper read,

On the Palæozoic Rocks of Alabama; by Prof. M. TUOMEY, *of Tuscaloosa, Alabama.*

[Not received.]

On the peculiar sensations produced by a Damp Atmosphere; by W. L. JONES, M.D., *of Athens, Ga.*

THE object of this paper, was to show that the chilliness of damp winds in winter is not due to an increased conducting power of moist air, there being no reason to suppose that the vapour of water has a greater conducting power than air itself, and direct experiments showing that its power in this respect is very limited. That the decrease in the amount of oxygen present when the barometer is low is a "vera causa," but not adequate to explain the phenomenon. That the experiments of BECQUEREL and BRESCHET, would seem to indicate that diminished activity of the skin, consequent upon decreased exhalation from the surface, lessens the calorifying power, and that a damp atmosphere, by diminishing evaporation, might

produce the same effect. It also suggests that as the atmosphere is positively electrified in dry weather, and negatively in damp, these different electrical states may be in part productive of the phenomenon in question.

Remarks on the Fossil Equus; by ROBERT W. GIBBES, M.D., *of Columbia, S. C.*

AT the last meeting of the Association, I exhibited several specimens of teeth of the horse found fossil in South-Carolina. Since then I have received others, which indicating its existence in various parts of the United States, furnish additional evidence of more than a single species.

The existence of the horse in a fossil state has long been known in England and on the Continent of Europe. In the History of Oxfordshire, by Dr. PLOT, (1676) there is a very good figure given of one found there. Sir JOHN HILL, in his History of Fossils, (1741,) mentions them as frequent in company with the teeth of elephants. CUVIER also mentions this latter fact as settling beyond doubt that they belonged to fossil species, and refers to many early notices of them.

After examining many in comparison with those of our horse, mule, ass and quagga, CUVIER could find no fixed character of difference on which he was willing to base a distinction from our present species. H. VON MEYER and Dr. KAUP have pointed out distinctions which are recognized by Prof. OWEN as well-marked, and by these gentlemen have several species been described.

EICHWALD has also pointed out some important differences in the form of the skull which deserve to be noticed.* MARCEL DE SERRES† makes distinctions in the form of the cranium and other bones, in the relative proportions of the teeth, and in the position of the incisor teeth and canines; but, after careful comparison with the living species, declines to separate the fossil, as he can fix on no absolute specific character of difference.

The distinction chiefly recognized by Prof. OWEN in the fossils of Oreston is in the narrow transverse diameter of the lower molars when compared with the recent horse.

* Nova acta Acad. Nat. Curios., vol. 9, p. 681.

† Recherches sur les ossemens humatiles des Cavernes de Lunel-viel.

In that from South America, submitted to him by Mr. DARWIN, (figured and described in the voyage of the Beagle,) a greater curvature is recognized inwardly, and not laterally, as in the recent species. On this character he bases a different species, *E. curvidens.* I here exhibit a specimen of this curved tooth from Missouri, and part of another from Ashley river, South-Carolina.

Dr. LUND, in 1844,* in his account of his discovery of numerous fossil bones in the caverns of Brazil, recognized two species of Horse differing from that now in existence, and he traces distinctions in the teeth. He mentions the fact, but does not state in what respect they differ.

Dr. LEIDY, in the proceedings of the Academy of Natural Sciences, Philadelphia, adopting the characters admitted by Prof. OWEN as distinctive, has established a new American species from Big Bone Lick, (Kentucky,) much larger than any noticed in Europe, which he calls *Equus Americanus.* He has also described a second species from Mississippi, which he considers as resembling *E. curvidens.* Both are from drift or alluvium.

I offer to the notice of the Association several specimens of *E. Americanus,* (LEIDY,) from the *Pliocene* of Darlington, (S. C.) where they are associated with the bones of *Mastodon;* another specimen is from the alluvium of Skidaway island, and another from an old slough in Richland district, (S. C.) probably a former bed of Congaree river. It was found in making a deep excavation for a trunk, below a bank, seventeen feet below the surface. Another specimen is from the bank of the Potomac, associated with a large molar of *Bos.*

The last specimen to which I invite your attention appears to me to differ from all previously described, in the thinness and minute plications of the enamel folds. Prof. OWEN has described a species based on the plications as *E. plicidens,* and traces its character as allied to the *Hippotherium* of KAUP—*E. primigenius* of VON MEYER

My specimen was found in a geological position different from any specimen of *Equus* previously discovered. I cut it from a mass of *Eocene* marl from Ashley river, firmly imbedded with the remains of *Manatus* and bones of Turtles, in marl from the plantation of JOHN A. RAMSAY, Esq. In the European species the *Miocene* is the oldest

* Mem. de la Soc. Royale des Antiq. du Nord, 1847

deposit where the teeth of *Equus* have been found. For this reason, and for the difference in the folds, I am disposed to consider it a new species peculiar to the *Eocene*, if it be not identical with the *E. plicidens* of OWEN.

In examining the characters of the teeth of the horse from the *Alluvium*, *Pliocene* and *Miocene* deposits, there seem to be marked distinctions in the folds of the enamel—in the former thicker and less plicated, and in the latter thinner and more plicated. The fact that no mammalian remains have heretofore been found in the *Eocene* marl of this country, except *Basilosaurus* and *Manatus*, is not an argument against the probability of our finding pachyderms, as Mr. OWEN has found them in the *Eocene* of England, of which he has many genera.

This tooth of *Equus* was not found in the recent formation from the washing of the marl bed, but in the solid marl itself.

On this paper, the following remarks were made by F. S. HOLMES, Esq., of Charleston, S. C.

MR. HOLMES remarked, that he had been living upon the Ashley about ten years, and during the last six had carefully examined every exposure of marl upon the river bank, and upon the creeks which empty into it; that the locality from whence Dr. GIBBES had sent him the specimen of a tooth of fossil *Equus* he had examined often—had collected many specimens of teeth of several genera from it, and was quite familiar with the surrounding country; that he had opened several pits in the marl bed, one of them seventy feet in length, twenty wide, and *twenty feet deep*, and several ten and twelve feet deep, but had never discovered a single specimen of the remains of *Equus*, or any other quadruped in the marl, nor had any of his friends with whom he had conversed, and of whom he had particularly enquired in regard to this matter, it being a subject in which he had been much interested for some time.

Further, that the beds of sands and clays, etc., which are superimposed upon the marl are very rich in these remains, and as many as twenty genera have been taken from them on the banks of the Ashley; that the surface of the *Eocene* marl is filled with holes, and into these holes the detrital matter of the upper beds, with their fossils, has been deposited. He doubts the propriety of re-

ferring these remains to the *Eocene* but thinks that they will, upon further investigation, prove to belong to the *Pliocene* or a still more recent formation.

Dr. R. W. GIBBES then read his papers on the Northern Fossil *Elephas*, on *Mastodon angustidens*, and on fossils common to several formations.

Remarks on the Northern Elephas of Prof. AGASSIZ ; *by* ROBERT W. GIBBES, M.D.

AT the meeting of the Association, held at Cambridge, in September last, Prof. AGASSIZ exhibited a molar tooth and two tusks of a new species of *Elephas*, found in Vermont.

The narrowness of the molar, with extreme thinness of the plates, together with a remarkable slenderness of the tusks and difference in their curve, induced him to consider that the species to which it belonged differed from *Elephas primigenius*. On my return from that meeting, I stopped a day at Wilmington, N. C., and there had submitted to my inspection, by Dr. W. C. WILLKINS, a molar, much broken, of this new *Elephas*, from Duplin Co., N. C. The tooth when found was entire, but careless handling had caused it to crumble. I am indebted to the gentleman named for what remains, being about two-thirds of the specimen.

It is therefore settled, that there are in the Southern States both species of *Elephas*, as the *E. primigenius* has been found in Georgia, by J. HAMILTON COUPER, Esq.

Remarks on Mastodon angustidens, by ROBERT W. GIBBES, M.D.

IT is well known to the members that there has been for several years some doubt existing whether the remains of *Mastodon angustidens* have been found in the United States. The whole evidence of the presence of this species rests on the tooth now in possession of the Academy of Natural Sciences, the history of which has been so earnestly and laboriously traced by our excellent associate, the venerable Prof. WARREN, of Boston, who, I may be permitted to say, has identified his name with that of the *Mastodon* on this continent, by his liberality in procuring, for the benefit of science, the finest specimen in existence. We owe to Dr. WARREN the minute

investigation of the circumstances connected with the existence of *M. angustidens* in the United States. His researches are too well known for me to repeat them here. I would merely state that the locality of the tooth alluded to is a few miles from Baltimore.

I lately received from Dr. FOREMAN, of Washington, a box of fossils, among which I discovered a fragment which I immediately recognized as of the enamel of *Mastodon angustidens*. I felt much interested in the fact, and immediately wrote to him to know from him its origin and history. It seemed another link in the evidence of the existence of *M. angustidens*. In reply, I was much disappointed to hear from him that it was found at Baltimore among the rubbish of ballast and trash used in filling up an old wharf, now covered by the tide and known as the Sunk Wharf. There being fossils of European origin among the material of which the wharf was composed, it is, unfortunately, impossible to say whether it be of foreign origin, or whether it belongs to the neighborhood. It is the only specimen of *M. angustidens*, except the tooth alluded to, found in the United States, and the fact of its having been found at Baltimore has made me notice it here, as the whole knowledge of the existence of this species in our country is associated with Baltimore.

DARWIN, in his Travels in South America, mentions *M. angustidens* as found with the remains of *Equus*, *Megatherium*, *Mylodon*, etc. As we have these remains in *Georgia* and other parts of the northern portion of our continent, we may reasonably hope yet to discover also *M. angustidens*.

Fossils common to several Formations, observed by ROBERT W. GIBBES, M.D.

IN my cabinet I have a large collection of teeth of Squalidæ from the United States, among which I find many common to several formations. The following catalogue was some time since prepared while arranging my specimens:

MIOCENE AND EOCENE.

Carcharodon	megalodon,	AGASSIZ.	Galeocerdo	minor,	AGASSIZ.
"	angustidens,	"	"	aduncus,	"
"	lanciformis,	GIBBES.	"	Egertoni,	"
"	sulcidens,	AGASSIZ.	"	latidens,	"
Hemipristis	serra,	"	"	contortus,	GIBBES.

Lamna acuminata,	AGASSIZ.	Oxyrhina hastalis,	AGASSIZ.
" cuspidata,	"	" xiphodon,	"
" elegans,	"	" Desorii,	GIBBES.
" Hopei,	"	" Sillimani,	"
" compressa,	"		

EOCENE AND CRETACEOUS.

Carcharodon acutidens,	GIBBES.	Lamna cuspidata,	AGASSIZ.
Glyphis subulata,	AGASSIZ.	" elegans,	"
Sphyrna lata,	"	Otodus obliquus,	"
" denticulata,	"	" appendiculatus,	"
Galeocerdo pristodontus,	"		

MIOCENE, EOCENE AND CRETACEOUS.

Galeocerdo pristodontus,	AGASSIZ.	Lamna cuspidata,	AGASSIZ.

With regard to this last communication, Prof. AGASSIZ remarked that this subject of identity of species proceeding from different formations, must be entirely reconsidered, and that comparisons between the formations in Europe and this country, could not be instituted without leading frequently to erroneous conclusions. Every thing in America bears the impress of an older date. Many forms, faunal and floral, now existing on the American Continent, are only found as fossils in Europe in the tertiary beds.

Mr. TUOMEY. The difference between the different strata of the tertiary can be determined by groups of fossils alone, and I think there are but few species common to two or more strata.

The Association adjourned to meet at 10 A. M. to-morrow.

LEWIS R. GIBBES, *Secretary.*

Third Day, Thursday, March 14, 1850.

MORNING SESSION.

PPROF. BACHE took the Chair at half past 10 A. M. Minutes of last meeting read and confirmed. Mr. F. S. HOLMES was appointed an additional Assistant Secretary.

The following gentlemen, nominated by the Standing Committee, were elected members:—Prof. HENRY L. EUSTIS, of Scientific School at Cambridge, Mass.; Prof. JOHN A. PORTER, do.; ROBERT C. LEWIS, Shelbyville, Ky.; GEORGE BLISS, Jr., Springfield, Mass.; EDWARD A. SPOONER, Plymouth, Mass.; HENRY GOURDIN, Esq., Charleston, S. C.; ROBT. N. GOURDIN, Esq., do.; Lieut. J. N. MAFFIT, U. S. N., Assistant in Coast Survey.

The programme having been read, Prof. MOULTRIE was requested to take the Chair, and Dr. HOLBROOK made his remarks

On the air bladder of the drum fish, Pogonias Fasciatus, and the mechanism by which is produced the sounds emitted by that fish at certain seasons.

[Not received.]

Professor AGASSIZ remarked that air-bladders in fish, like lungs in higher vertebrates, are in the embryonic state, as it were herniæ from the intestinal canal, air-bladders being developed from the upper surface of the alimentary canal, and lungs from the lower; that the ultimate state arising from further changes is different in different cases,—in one, the air-bladder is finally obliterated altogether,—in another, it continues to exist, but the connection with the intestinal canal is obliterated,—in a third case, the air-bladders become cellular, and remain connected with the intestinal canal, which is the highest state of development. Air-bladders in a limited degree perform the function of respiration.

Dr. EDMUND RAVENEL, by permission, called up for further discussion, that portion of Professor TUOMEY's paper, yesterday, which related to the coal-fields of Alabama, and pointed out the importance of those fields for the purpose of supplying steamers on the Pacific,

being nearer to those waters than any point where coal is found in abundance, and lying on navigable streams.

Prof. TUOMEY, in reply to queries, stated, the coal is transported to Mobile, and sold there at about $2,75 to $3,00 per ton; its quality is highly bituminous.

Lieut. MAURY called attention to the importance of these coal fields on the commerce of the Pacific. As soon as communication across the isthmus is fully established, the products brought down the Mississippi, from the vast area of the valley of the Mississippi, will find their way from the Gulf to the Pacific Coast. Steam navigation is necessary there on account of calms, and the coal needed is now principally supplied round Cape Horn, at a cost of $16 per ton. The demand in two years will probably reach 100,000 tons, and in this view, the Alabama Coal fields are of vast importance.

Prof. AGASSIZ asked leave to add a few remarks to those made on Dr. R. W. GIBBES' paper of last evening. He still maintained his position that there are very few species, if any, that are common to different formations; the mistakes that have arisen in this respect being attributable to errors in determining the nature of the formations. Geologists apply to Zoologists to determine specimens which have been taken from different localities, and the Zoologist decides that they belong to the same species. The Geologist calls some of these localities Eocene, and others Miocene, and concludes that certain species are identical in different formations; but that conclusion rests with the Geologists. Again, the same rule does not obtain in the different classes of the animal or vegetable kingdom, as for instance, the Algæ of Key West, and those of the Mediterranean, in very many instances belong to the same species, while the Fishes of the one region are quite different from those of the other. Also, northern species are found in more southern latitudes, but at greater depths.

Dr. GOULD does not believe in the identity of shells from different oceans,—careful investigations show that they differ.

Remarks on the same subject were also made by Prof. TUOMEY, and Dr. EDMUND RAVENEL.

At a quarter before one o'clock, the Association took a recess, pursuant to order of Standing Committee reported this morning, and at one re-assembled, Prof. BACHE taking the Chair, and announcing the report of the Standing Committee as follows:

There will be an evening meeting to-morrow, at the South-Carolina Hall, at 6 P. M.; Lieut. MAURY's paper, on the Circulation of the Atmosphere, and Prof. BACHE's account of the measurement of the base line on Edisto Island, to be the subjects for the meeting.

The Chair also announced an invitation from Hon. M. KING and lady for to-morrow evening at 8 o'clock.

Dr. JAMES MOULTRIE was then requested to take the Chair, and Prof. TUOMEY laid before the Association a specimen of a fossil lacertain reptile, belonging to the genus *Leiodon*, from the cretaceous of Alabama. He mentioned the name of the discoverer of the specimen, Prof. SHERMAN, Howard College, Ala., and made remarks on the growth of the teeth, etc.

Prof. AGASSIZ said that he considered the discovery of this fossil, one of the most splendid additions to the Palæontology of the United States ever made, and that although several parts are yet wanting, it enables us to construct the animal completely.

Lieut. MAURY read his paper,

On the Currents of the Atlantic Ocean.

LIEUT. MAURY said that in studying the system of oceanic circulation he had found it necessary to set out with the very obvious and simple principle, viz: that from whatever part of the ocean a current was found to run, to the same part a current of equal volume was obliged to return.

Upon this principle was established the whole system of currents and counter-currents.

He also remarked that it was not necessary to associate with oceanic currents the idea that they must of necessity, as on land, run from a higher to a lower level.

So far from this being the case, some currents of the sea actually run up hill, while others run on a level.

The Gulf stream was of the first class. In a paper read before the National Institute in 1844 he had shewed that the bottom of the

Gulf stream was an inclined plane, running upwards. If the Gulf stream was 200 fathoms deep in the Florida pass, and but 100 fathoms off Hatteras, it is evident that the bottom would be uplifted 100 fathoms within that distance, and, therefore, while the bottom of the Gulf stream was uphill, the top preserved the water-level, or nearly so.

The currents which run from the Atlantic into the Mediterranean, and from the Indian ocean into the Red sea, were the reverse of this. Here the bottom of the current was a water-level, and the top an inclined plane, running *down hill.*

Lieut. MAURY took the Red sea current as an illustration. That sea, he remarked, lies for the most part within a rainless and riverless district. It may be compared to a long and narrow trough.

Being in a rainless district, the evaporation from it is immense; none of which is returned to it by rivers.

It is about 1000 miles long; it lies nearly north and south, and extends from latitude 12° or 13° to the parallel of 30° north.

Lieut. MAURY was not able to state the daily rate of evaporation there; but he thought it might safely be assumed—and for the illustration he would assume it—at the rate of two-tenths (0.2 in.) of an inch a day.

Now, if we suppose the current which runs into that sea to average from mouth to head 20 miles a day—and this was conjectured merely for the purpose of illustration also—it would take the water fifty days to reach the head of it. If it lose two-tenths of an inch from its surface, by evaporation, it would appear, that by the time it reached the isthmus of Suez, it would have lost ten inches from its surface.

Thus the waters of the Red sea ought to be lower at the isthmus of Suez than they are at the straits of Babelmandel. They ought to be lower from two causes, viz: evaporation and temperature—for the temperature of that sea is necessarily lower at Suez, in latitude 30°, than at Babelmandel, in latitude 13°.

To make this quite clear, suppose the channel of the Red sea to have no water in it, and a wave ten feet high was to enter the straits of Babelmandel, and was to flow up this channel at the rate of twenty miles a day for fifty days, losing daily, by evaporation, two-tenths of an inch, it is easy to perceive that at the end of the fiftieth day it would not be so high, by ten inches, as it was the first day it commenced to flow.

The top of that sea, therefore, is probably an inclined plane.

But the salt water, which has lost so much of its freshness by evaporation, becomes salter, and, therefore, heavier. The lighter water at the straits cannot balance the heavier water at the isthmus, and the colder and salter, and, therefore, the heavier water, must either run out as an under-current, or it must deposit its surplus salt in the shape of crystals, and thus gradually make the bottom of the Red sea a salt bed; or it must abstract all the salt from the ocean—and we know that neither the one process nor the other is going on. Hence we infer that there is from the Red sea an under or outer current, as from the Mediterranean, through the straits of Gibraltar.

And, to show why there should be an outer and under current from each of these two seas, the case was supposed of a long trough, opening into a vat of oil, with a partition to keep the oil from running into the trough. Now, suppose the trough be filled up with wine, on one side of the partition, to the level of the oil.

The oil is introduced to represent the lighter water, as it enters either of these seas from the ocean, and the wine the same water, after it has lost some of its freshness by evaporation, and, therefore, become salter and heavier.

Now, suppose the partition to be raised, what would take place? Why, the oil would run in as an upper-current, and the wine would run out as an under-current.

The rivers which discharge in the Mediterranean are not sufficient to supply the waste of evaporation—and it is by a process similar to this that the salt which is carried in from the ocean is returned to it again; were it not so, the bed of that sea would be a mass of solid salt.

The equilibrium of the seas is preserved by a system of compensations as exquisitely adjusted as those by which "the music of the spheres" is maintained.

Lieut. Maury said he had also, on a former occasion, pointed out the fact, that, inasmuch as the Gulf stream was a bed of warm water, lying between banks of cold water, the warm water was lighter, and, therefore, the surface of the Gulf stream was in the shape of a double inclined plane, like the roof of a house, down which there was a shallow surface or roof current, from the middle, towards either edge of the stream.

This fact had been confirmed in a singular way: A person, who had been engaged on the Coast Survey, with observations on the

Gulf stream, had informed the Lieutenant that when he tried the current in a boat, he found it sometimes one way and sometimes another, but scarcely ever in the true direction; whereas, the vessel, which drew more water, showed it to be constantly in one direction.

The object of the lecturer was, not to account for the currents of the Atlantic, but merely to mention the fact, that he might call the attention of the Association to it, that, though there be well-known currents which bring immense volumes of water *into* the Atlantic, we know of none which carry it out again, and which, according to the principle with which he set out, ought to be found running back from that ocean.

The La Plata and the Amazon, the Mississippi and St. Lawrence, with many other rivers, run into this very small ocean, and it is not probable that all of these waters are taken up from it again by evaporation; "yet the sea is not full." Where does the surplus go? The ice-bearing current, from Davis' straits, which is counter to the Gulf stream, moves an immense volume of water down towards the equator.

The ice-bearing current which runs from the Antarctic regions, and passes near Cape Horn into the Atlantic, and the Lagullas current, which sweeps into it around the Cape of Good Hope, both move immense volumes of water, and bear it along also towards the equator.

This water must get out again, or the Atlantic would be constantly rising.

A part of the Gulf stream runs around North Cape into the Arctic Ocean. The thermal charts of the Atlantic Ocean now in process of construction, under the direction of Lieut. Maury, at the National Observatory, prove this, as also do the admirable charts of Prof. Dove, of Berlin.

But the Lecturer proceeded to shew that this current probably performs its circuit of the Arctic Ocean, and returns to the Atlantic with increased volume.

There are the rivers of Northern Europe and all the great rivers of Asia and America, that empty into the Frozen Ocean, also the current from the Pacific Ocean, into Behring's Straits, all these sources of supply, serve, in the opinion of the Lieutenant, to swell the current down from Baffin's Bay through Davis' Straits into the Atlantic.

That there was an open water-communication sometimes at least

around the Capes, into the Atlantic, where, therefore, was the escape-current from the Atlantic?

The Trade Winds, Lieut. MAURY was prepared to show, were the great evaporating winds. They were the winds, which, returning from the Polar regions, deprived of all the moisture which the hyperborean dew points could compress from them, first came in contact with the surface of the earth, and consequently with an evaporating surface, when they were first felt as trades, and where, therefore, they were dry winds.

Now could the vapor taken up by these winds so increase the saltness of this sea in the trade wind region, as to make the water there though warmer, yet specifically heavier, than that below, and also than that within the regions of the variable winds and of "constant precipitation?" If so, might we not have the anomaly of a warm under current in the South Atlantic Ocean, for that was the only place of escape for a counter current from the Atlantic?

Lieut. WALSH, who had been sent out by the Government, in the schr. *Taney*, to make certain observations in connection with Lieut. MAURY's researches concerning the winds and currents of the Ocean had been instructed, among other things, to examine for such a current.

Remarks were made by Dr. A. A. GOULD, and Prof. AGASSIZ. The latter asked who now is to be regarded as the discoverer of the Southern Whale, mentioned by Lieut. MAURY, he who had pointed out the existence of a new species by careful investigation, of whatever kind, or he who shall first describe it zoologically. This case is a good lesson, said he, on the fancied importance of the name of the first describer.

Prof. W. H. HARVEY, of Trinity College, Dublin, then entertained the Association with observations on the Marine Flora of the Atlantic States. There exists a greater degree of similarity on the Marine Flora of the two sides of the Atlantic, than in their Marine Fauna, from the facility with which the spores of the Algæ may be transported to a great distance by natural agencies. But, from the rise of the isothermal lines on the European side, the species of low latitudes in America are similar to those of higher latitudes in Europe; those of Key West, for instance, in latitude 24°, are similar to those of the Mediterranean. It is not yet possible to mark out

with precision the geographical distribution of the Algæ along the coast, but differences may be perceived in the Marine Flora of the region north of Cape Cod, that of Long Island Sound, that of Charleston Harbor, and that of Key West. The Flora of each of these regions was illustrated by numerous dried specimens of great beauty.

In reply to a question by Lieut. MAURY, whether the sargasso weed was found in the Pacific, and to one from Prof. BACHE, whether a marked change was not found at Cape Hatteras in the Flora of the Coast, Prof. HARVEY said that the present state of knowledge would not furnish answers to these questions.

Prof. BACHE said that these queries showed the advantage of a general meeting over sectional meetings, in cases where different branches of science touch closely on each other, as in the relation of currents to distribution of marine plants and animals. Prof. BACHE and Lieut. MAURY added interesting remarks on the Gulf stream and on the cold currents which run in connexion with it.

Adjourned at half past 2, to meet at 6 P. M.

LEWIS R. GIBBES, *Secretary.*

Third Day, Thursday, March 14, 1850.

EVENING SESSION.

PROF. BACHE took the Chair at half past six. Mr. JOHN BINNEY, of Boston, nominated by the Standing Committee, was elected a member.

Dr. ROBERT W. GIBBES was called to the Chair, and the first paper was read,

On the Comparative Reflecting Power of the planets Mars, Jupiter and Saturn; by Prof. LEWIS R. GIBBES, *of College of Charleston, S. C.*

AMONG the photometric problems that have been proposed, with relation to the light of the heavenly bodies, I do not know that the comparative reflecting power of the planets has yet found a place. My attention was called to the subject eight or ten years since at one of the oppositions of Mars, by the remark that Mars at that time was as bright as Jupiter at his opposition. In the absence of

photometric apparatus adapted to the inquiry, the only method of proceeding was to make use of the power of the eye to estimate with considerable accuracy of the equality of two lights, though its judgments be very erroneous with regard to the ratio of two lights of unequal intensity, to wait for those positions of any two of the planets, at which they would, in the course of their periodic variations in brilliancy, appear equally brilliant, and from the proper data, compute their respective reflecting power. This method, as may be supposed, furnishes few opportunities for comparison, and at irregular intervals, unfavorable therefore to regular pursuit of the subject, but some of the results derived are worthy of mention.

Mars, from the great variations in brilliancy it undergoes, is best adapted for effecting comparisons between the planets, being at times brighter than Jupiter, and at others comparable with Mercury. The red color of its light is a difficulty in the way of a proper comparison of lights, which, however, is unavoidable by any photometric method at present used. The principles and data used in the calculation are as follow:—The apparent light of a planet is proportional to

$$\frac{\text{the area of its great circle}}{(\text{its distance from the earth} \times \text{its distance from the sun})^2};$$

the mean distance of the Earth from the Sun is taken as the unit of distance; the area of Mars at the unit of distance from Earth as unit of area; the light of Mars at unit of distance from Sun and Earth as unit of light.

		Semid.	*Area.*
Mercury, semi-diameter,		3.23	0.529
Venus,	do.	8.25	3.453
Mars,	do.	4.44	1.000
Jupiter, Equat. semi-diameter,		99.70	
	Polar do.	92.43	
	Mean do.	96.00	467.458
Saturn, Equat. semi-diameter,		81.11	
	Polar do.	75.19	
	Mean do.	78.09	309.363
Ring, Exterior semi-diameter,		191.23	1034.396
	Interior do.	127.19	

The preceding table gives the dimensions of the planets in seconds, at the unit of distance, derived from the Nautical Almanac for 1836,

preface page vii, and the dimensions of Saturn's Ring at the same distance, from page 315 of HERSCHEL's Astronomy, London, 1849, and the areas, expressed in the above unit, derived from those data. It is to be observed, however, that the mean distance of Saturn used in these reductions 9.53877, is less than that employed in BOUVARD's tables.

The mean semi-diameters of Jupiter and Saturn are geometrical means between their equatorial and polar semi-diameters respectively, or are the semi-diameters of circles equal to them in area. Where the whole area is not illuminated, it must be multiplied by the versed sine of the part illuminated, the diameter being taken as unity, or what is the same thing by $\frac{(1 + \text{cos. annual parallax})}{2}$ radius being taken as unity. In the case of the Ring of Saturn, the area must be multiplied by the sine of the angle of elevation of the Earth above the plane of the Ring, as seen from Saturn, that is by sine of *l*, given in Nautical Almanac. The dates of observation and the results of calculation are as follow:

MARS AND JUPITER.

	BRIGHTNESS. MARS.	BRIGHTNESS. JUP'R.	RATIO.
1843, June 6, Mars, at opposition, was judged equal to Jupiter at his last opposition; comparison being effected from memory, not held as of much value, ...	2.087	0.848	2.455
1845, July 10, Mars equal to Jupiter, both at same altitudes, though not near; Jupiter being nearer to the early dawn, to be regarded as somewhat the brighter, ...	2.171	0.705	3.079
1847, Oct. 1, Mars and Jupiter nearly equally bright, but Mars certainly the brighter, . .	1.980	0.631	3.140
1847, Oct. 30, Mars and Jupiter now equally bright, Mars in opposition, ...	2.266	0.749	3.025

In all these observations, the brightness of Mars, calculated on the supposition of equal reflective powers, ought to be about three times that of Jupiter; but, as observation shows that they were nearly equally bright, it follows that the reflecting power of Jupiter is as much greater than that of Mars. If we reject the first observation, which, however, is not greatly discordant, we may take 3 as the relative reflecting power of Jupiter, that of Mars being unity.

MARS AND SATURN.

	Brightness. Mars.	Brightness. Saturn.	Ratio.
1841, Oct. 17, Mars equal to Saturn in brilliancy at time of conjunction, ...	0.203	0.062	2.952
1843, Oct. 16, Mars and Saturn near conjunction, and not very unequal, but Mars certainly the brighter, ...	0.425	0.065	6.206
1849, June 22, Mars and Saturn equally bright, about a month past conjunction, ...	0.211	0.048	4.213

In these observations from the sum of the areas of Saturn and the Ring (the latter area diminished in the ratio above stated) has been subtracted that portion of the surface of the Ring concealed by the planet, and that of the planet concealed by the Ring. Taking the first and last of these observations, the only two obtained in which the planets were judged equal, it would appear that Saturn reflects light three and a half times more powerfully than Mars, and, therefore, somewhat more powerfully than Jupiter.

The observations on which the above comparisons rest, are defective in not having been pursued in each case from such time as one of the pair of planets observed appeared the brighter, until the other appeared the brighter, and thus bringing within known limits the epoch of equality of brightness. This arises, in some degree, from the uncertainty when these epochs would arrive. In the subsequent computations, also, has been omitted the unequal extinction of light, arising from the difference of the lengths of the paths of the rays through the atmosphere. This source of error was eliminated as far as possible by comparing the planets when at high and nearly equal altitudes.

Despite these defects, it seems safe to draw the following conclusions from the above results:

That it is certain that Saturn and Jupiter reflect light more powerfully than Mars, including under the term "reflecting power" all the agencies at the surface of the planet that affect the light in its course from the Sun to the planet, and thence to the Earth:

That it is probable that the reflecting power is the greater the more distant the planet from the Sun:

That these results will serve to predict the epochs of equality of light, and thus prepare for observation.

Attempts have been made to compare the planets Jupiter and

Venus, but it is difficult to find them in proper positions when nearly equal in light, and the proximity of the latter to the horizon and to twilight, at the times of observation, are great difficulties in the way of a proper comparison.*

Prof. BACHE then read the following paper:

Report of F. DE POURTALES, *Assistant U. S. Coast Survey, on the Distribution of the Foraminiferæ on the Coast of New-Jersey, as shown by the off-shore soundings of the Coast Survey. Communicated by* Prof. A. D. BACHE.

THE first idea of forming a systematic collection of specimens of the bottom of the sea, in the Coast Survey, originated with the late Lieut. GEO. M. BACHE, U. S. N. It was his intention to have classified and arranged them on a chart, so as to present to the eye a general view of the bottom of the sea, as on a geological map. His well-known zeal and ability are a guaranty that we would have had to expect very interesting results from his labors, had not an untimely death cut him off in the midst of his scientific researches in another branch of science.

The collection begun by him has been increased every year since 1844; the specimens of the material of the bottom of the sea, brought up by the Stellwagen lead, are put in small bottles, with a label indicating position, depth, etc. Prof. BAILEY, of West Point, has examined, microscopically, a number of them submitted to him

* Since the meeting of the Association an opportunity has occurred for comparing the planets Jupiter and Venus, under tolerably favorable circumstances. On the 6th of May, Jupiter was decidedly brighter than Venus; on the 20th of May, a nearer approach to equality, but Jupiter still the brighter; on the 6th of June, Venus appeared the brighter of the two, in about the same ratio as Jupiter on the 20th of May; the 29th May may be taken as the epoch of equal brightness. Their brightness and ratio at these dates were as follow:

	JUP'R.	VENUS.	RATIO.
May 20, ...	0.607	2.509	4.134
" 29, ...	0.575	2.586	4.497
June 6, ...	0.548	2.657	4,850

Jupiter appears to have a reflective power *four* times as great as Venus, which seems to be inferior to Mars in this respect—a result which, at least, does not invalidate the second of the above conclusions.

by Prof. Bache, and the highly interesting results have been laid before this Association at its meeting in Boston.

Last year, at the recommendation of Prof. Agassiz, Prof. Bache requested me to undertake the examination and classification of the whole collection, with especial reference to the conclusions which might be useful in the off-shore chart from Gay Head to Cape May, preparing for publication at the Coast Survey office, and under special instructions as to the practical results which were sought. A preliminary report—the result of the examination of 700 specimens—was sent in in October last. Since that, the whole number of specimens examined amounts to about 1400. But in the following paper the results of only about 1200 have been used, rejecting those extending too much beyond the region comprehended between the 38th and 40th degrees of latitude, and between the shore and the farthest point they reach, which is about the 100 fathom curve.

The principal object of this investigation was to see what data useful to navigators could be obtained from the knowledge of the distribution of organisms on the bottom of the sea, and especially of the foraminiferæ or polythalamia, on account of their abundance and diversified forms. The results, so far, have proved more interesting to the naturalist than practically useful to the navigator, though not without their interest in this point of view. The distribution of the foraminiferæ (the most abundant of the organisms found in deep sea soundings) has been found to depend, as far as this region is concerned, altogether upon the depth at which they are collected. It is still hoped, however, that some useful data may be obtained from a more extended investigation.

To obtain those results, a series of tables was formed, in which the results of the examination of every specimen were entered, under the heads of position, depth, character of bottom, and fauna. By means of these tables, the diagram exhibited has been formed. A curve represents there the slope of the bottom of the sea from the shore to deep water. It follows a line running about south-east, beginning near Great Egg Harbor, (N. J.) The slope is, of course, highly exaggerated—the unit for the abscissa being the mile, and for the ordinates the fathom. The initials on top indicate some of the most characteristic genera of foraminiferæ, in nearly the order of the first appearance, with increasing depth. The figures under each initial indicate the number of soundings in every region of ten fathoms range, in which specimens of the species indicated by the initial

were found. They are only expressive of the proportion for the horizontal line in which they are placed, the number of soundings being proportionate to the area covered by a given depth of water.

The species used are: *Quinqueloculina Occidentalis*, Bail.,—*Triloculina Brongniartiana*, d'Orb.,—*Biloculina subspherica*, d'Orb.,—*Guttulina*,————*Rotulina Baileyi*, mihi,—*Robulina d'Orbignyi*, Bail.,—*Marginulina Bachei*,—*Dentalina costata*, mihi,—*Globigerina rubra*, d'Orb.,—*Orbulina universa* d'Orb.

The results of the examination are recorded in the following table, which shows the number of soundings of the different depths which contained the several foraminiferæ, and the whole number of specimens of the bottom at the several depths examined.

Depth in fathoms.	Quinqueloculina.	Triloculina.	Biloculina.	Rotulina.	Guttulina.	Robulina.	Marginulina.	Globigerina.	Dentalina.	Orbulina.	Number of soundings examined.
5	0	0	0	0	0	0	0	0	0	0	8
10	2	0	0	0	0	0	0	0	0	0	61
15	15	2	0	1	1	0	0	0	0	0	211
20	28	13	0	3	10	1	1	0	0	0	268
25	32	31	7	32	8	1	0	1	0	0	189
30	27	31	1	52	14	2	0	0	0	0	140
35	19	14	6	64	9	13	17	3	0	1	124
40	9	13	1	45	9	29	27	7	0	1	80
45	5	11	10	27	3	27	40	7	5	0	46
50	1	2	2	4	0	7	7	2	1	1	12
55	0	0	1	2	0	7	8	1	0	0	8
60	1	1	2	2	0	7	7	7	4	0	9
65	0	0	1	6	0	15	17	16	10	4	19
70	0	1	0	2	0	5	5	4	4	1	4
75	0	0	0	1	0	1	1	1 !	0	1	2
80	0	0	0	0	0	0	0	0	0	0	00
85	0	0	0	0	0	2	2	1 !	2	2	2
120	1	0	0	1	0	2	2	2 !	1	0	2
145	0	0	0	0	0	1	0	1	0	0	1
160	0	0	0	0	0	0	2	2	0	0	2
200	0	0	0	1	0	0	0	1 !	0	0	1
											1189

If we now follow the line, beginning at the shore, we will first find a region almost entirely bare of foraminiferæ. This region extends to the depth of about fifteen fathoms. Now and then isolated *Triloculinæ* and *Quinqueloculinæ* are found. The bottom is mostly composed of a quartzose sand exposed to the motion of the water, and consequently not well adapted as a habitation for so delicate animals. Beyond the depth, the foraminiferæ become more abundant in species and individuals. At the depth of about sixty fathoms, we find one species—the *Globigerina rubra* becoming extremely preponderant in number, and its abundance seems to increase with depth. The greatest depth from which specimens have been examined in this investigation, is two hundred and sixty-seven fathoms, and there the *Globigerina* is still living in immense numbers—sometimes their number seems almost tô equal the grains of sand. The bottom in this region is a fine dark grey sand.

We may therefore distinguish three regions characterised by foraminiferæ; the first near the shore, without any, extends to about fifteen fathoms, the second goes to about sixty fathoms, is characterized by a great number of species, of which the *Rotulina Baileyi* seem to be most numerously represented. At about sixty fathoms the *Globigerina rubra* is preponderating, and the *Rotulina Baileyi* disappears, and this last region extends to a depth not yet known.

I may remark, incidentally, that between the depths of nine and forty fathoms, almost every sounding brings up fragments of the *Echinarachnius parma*, usually dead, sometimes alive.

The whole region examined is very uniform in its slope, and as has been shown above, is comprised between limits presenting no striking peculiarities. It can therefore be assumed that it is comprised in the district of one and the same marine fauna. Subsequent examinations of soundings from various parts of the coast, will no doubt show where the faunæ change, perhaps their limits will be drawn with as much sharpness for the foraminiferæ, as they are for other inhabitants of the sea, as for instance the shells at Cape Cod, which are different on the North and South side of it, as shown by Dr. Gould. If this is the case, as there is good reason to hope, we will then be able to obtain some data, which will give much weight to the information which the Navigator gets from the examination of the bottom when sounding.

Prof. Bailey has left very few species undescribed. I will add

here a list of those which seem to have escaped his attention, and describe some of them which seem to be new.

Dentalina costata, mihi. Shell white, slender, regularly arcuated, marked with strong longitudinal ridges, extending to the aperture, which is on the pointed end of the last cell. Found in deep soundings.

Polystomella Poeyana, d'Orb. (Foraminiferæ de l'ile de Cuba.) Found quite abundant in ten and twelve fathoms of water in the neighborhood of Cape Henlopen.

Rotulina Baileyi, mihi. Shell convex above, flat below, white, perforated with small round holes. No umbilical disc. Aperture in form of an arch, with a raised lip. Common.

Protalina agglutinans, mihi. Larger than preceding. Shell rough, with grains of sand incrusted; last whorl of the spire nearly covering the other ones; aperture indistinct in the specimens examined. Rare. Found in twenty, thirty, and forty fathoms.

Clavulina rugosa, mihi, resembles very much *Clavulina nodosaria* d'Orb., but is thicker in proportion to length. Shell rough, yellow, cylindrical, last cells of increased diameter. Rare. Found in sixty fathoms.

Guttulina lævis, mihi. Shell white, vitreous, very smooth, elongated, both ends nearly equally rounded, aperture terminal, surrounded by small radiating ridges. Pretty common. I have seen a figure of it, by Professor Bailey, but cannot learn that it has received a name yet.

Textularia turbo, mihi. Shell in form of a cone, with nearly circular base, rugose greyish, with an elongated aperture in the base of the cone. Found usually in company with *Textularia Atlantica*, Bail. in deep soundings.

Biloculina subspherica, d'Orb. (Foraminiferæ des Canaries.)

Prof. Agassiz observed that naturalists are not only much indebted to the Coast Survey for aid in investigations in natural history, but here they have a large fauna exhibited at once to them in this collection, made by the Coast Survey—a collection whose importance is great in a scientific point of view, even were the practical value small. Besides, remarked he, Mr. Pourtales has just communicated an important paper on a striking analogy in the growth of plants, and of certain types in the animal kingdom, of which the following abstract was given:

On the order of Succession of Parts in Foraminiferæ, by L. F. DE POURTALES. *Communicated by* Prof. AGASSIZ.

SINCE the identity of the intimate structure of animals and plants has been ascertained by LEHMAN, various attempts have been made to trace an analogy between the growth of the various types in the two kingdoms. These attempts have failed, in as far as the analogy has been found very loose, and the strong contrast which exists between them has been more fully brought out, rather than an agreement.

Mr. POURTALES has, for the first time, pointed out a direct, well-sustained analogy, which is to be found in the order of succession of the cells in foraminiferæ of the genera *Textularia*, *Candima*, *Biloculina*, *Triloculina* and *Quinqueloculina.* This succession agrees fully with the succession of leaves in plants—so fully that it can be expressed by the same fractions with which botanists are now in the habit of expressing phyllotaxis in the vegetable kingdom. This is, therefore, an important additional link in the investigation of the plan which regulates the normal position of parts in organised beings—a link which may lead to include into one universal formula the rhythmic movements which preside over the development of all finite beings, as the phyllotactic formulæ themselves are now known to express also the natural relations which exist in the movements of the bodies belonging to our solar system.

After making the communication, illustrated by diagrams on the black-board, Prof. A. proceeded with his own paper on the classification of the Animal Kingdom.

On the Principles of Classification, by L. AGASSIZ.

IT may be said that investigations upon the structure of animals have already yielded all the information coming from this source which can serve to improve our classification of the animal kingdom.

After the great natural divisions of the animal kingdom have been circumscribed in accordance with their anatomical structure; after the classes of the animal kingdom have been characterized by organic differences, it is hardly possible to expect that further investigations upon the structure of animals will afford the means of

establishing correctly the natural relations of the families. For it is already seen that the amount of organic difference which exists between the different families is either too insignificant to afford a test by which to settle their pre-eminence or inferiority, or so striking as to impress us with an *exaggerated* idea of their difference. Many examples could be quoted to show, that, in this respect, from the same identical facts, naturalists have arrived at very opposite conclusions. And this diversity of opinion among investigators of equal ability leads me to think that comparative anatomy has done its work in that direction, and that we must seek for another principle in order to settle in a natural way the respective positions of the minor divisions throughout the animal kingdom, and to set aside, once forever, the arbitrary decisions which we are constantly tempted to introduce into our classifications, whenever we attempt to arrange all the families in natural groups. Before so much had been done to improve the natural classification of the animal kingdom, it was hardly possible to notice how much was, on every occasion, settled by induction, and even arbitrary decision, beyond what the knowledge of facts would justify—for the brilliant results which the introduction of comparative anatomy, as the foundation of the classification of the animal kingdom, has brought to light, must naturally have blinded us to the imperfections and deficiencies which constantly accompany the most important improvements in the natural arrangement of every class. Nevertheless, our confidence in the possibility of ascertaining the natural relations of all animals has been increased by the growing agreement between the different systems; and there is no philosophical observer who has not noticed this process of gradual approximation towards a greater uniformity in the view taken by different observers of the natural affinities of animals, however concealed this agreement has often been in consequence of changes of name or transposition of the order in which the objects were introduced.

The time has, however, gone by, when the mere translation of family names, or of more general or minor divisions, into another language, could be presented as a new system, and the raising of a secondary division into the rank of a primary group, or the lowering of a primary division into a subordinate position, constituted an improvement in the knowledge of the natural relations of animals. Nothing short of a material addition to the information we possess respecting any group of animals, can now be considered as a real advance in Zoölogy.

It should be further considered that our object is not merely or chiefly to ascertain the structural relations of animals, but to know all the various relations which have been established between them, and which they sustain towards the world in which they live. The knowledge of the natural embryonic development—of the order of succession in geological times—of the geographical distribution upon the surface of our globe—and of the habits arising from their natural relations to the elements in which they live—all these considerations are of as great importance in our zoölogical studies as the knowledge of the structure and functions of their organs, to which, of late, more exclusive attention has been paid.

When comparing, in former years, the characters of fossil fishes, especially with a view of ascertaining their natural relations to the living types, I was struck with the fact that those of earlier ages presented many structural peculiarities, which occur only in the embryonic condition of the fishes of our days, and also that the older representatives of any family rank lower in comparison to their living representatives.

This led me to infer that embryonic data might be applied with advantage to the correct appreciation of the natural relations of the various members of one and the same family, and perhaps also to the determination of the relative position of closely allied types.

Under this impression, I began to compare young animals of various families with the different types of the same family in their full grown condition, when I was forcibly struck with the close resemblance there is between the younger stages of development of such representatives as could otherwise be recognized as ranking high in their respective families, and the lower forms belonging to the same groups. This led naturally to the conclusion that the change which animals undergo during their growth might safely be taken as a standard to determine the natural order of succession of all the representatives of any given type within the limits in which the higher ones pass successively through transient forms which the lower ones naturally present permanently in their full grown condition.

This principle, once ascertained, led to the result, upon more extensive investigations, that a complete knowledge of the metamorphoses of animals, from the earliest period of their embryonic development to the last change they undergo before reaching their mature condition, would afford, throughout the animal kingdom, a true measure by which to ascertain precisely, and without arbitrary decision on

our own part, the natural relative position of all the minor groups of the animal kingdom.

Beginning the revision of the animal kingdom with the type of Articulata, it was not difficult, with these views, to ascertain that the Worms, as a natural type, rank lowest in this department, as they represent permanently a structural adaptation which is closely analogous to the earliest condition of development of the insects; that the Crustacea constitute a class intermediate between the Worms and Insects, and not superior to the Insects, as some naturalists would have them; inasmuch as the highest combination of their rings presents us with an arrangement similar to that of the pupa of Insects, in which the joints of the head and of the chest are combined in an immovable shield, as in the pupa of Insects, and in which the joints of the abdomen alone remain moveable, is also the case among the highest Crustacea. The position of the Insects as the highest class, can no longer be denied, when we consider that in them the body is at last divided into three distinct regions—head, chest and abdomen—and that the locomotive appendages, which, in the lower classes, are so numerous and uniform along the whole length of the body, are reduced to the region of the chest, and assume there a particular development.

Again, the transformation of the respiratory organs is an additional evidence in favor of such an arrangement, as will be admitted from the fact that Worms and Crustacea have chiefly a branchial respiration, while in Insects it becomes aerial, in their perfect condition at least.

Once upon this track, it was easy to follow out the minor changes which these animals undergo during their final transformation, and to derive from the knowledge of these changes sufficient information to assign a definite position to all the subordinate groups in each of these classes. Taking the Insects, for instance, into special consideration, we ascertain readily that chewing Insects rank below the sucking tribes, as their larvæ are chewing worms, provided with powerful jaws, even in the case of those which, like Lepidoptera, have the most perfectly developed sucking apparatus in their mature condition.

Again, an investigation of the changes which the wings undergo in their formation, and the manner in which they are unfolded, when the perfect insect is hatched, led to the discovery that Coleopterous Insects, far from ranking high, must be considered as lowest among Insects, inasmuch as the upper larval wings of Lepidoptera are a sort

f elytra, which, after being cast in the last moulting, are succeeded y the more perfect membranous wing, which in its turn, undergoes ıch a development as to assign to those Lepidoptera, which have heir wings folded backwards and enclosing the body, a position below hose in which the wings spread sideways; and the highest position o those which raise their wings upwards. So that these investigaions have settled even the relative position of the secondary minor roups in each of these orders, and though, as yet, imperfectly traced ut, they have at least shown the principle upon which a natural lassification of these animals might be carried into the most minute etails, without ever leaving any point to our arbitrary decision. Similar results have already been arrived at in other classes; as, for nstance, among Medusæ, where naked-eyed Discophori, with alternate enerations, must be considered as the lowest type, recalling, in one f their conditions, the appearances of the inferior class of polypi; when the covered-eyed Discophori, with their strobiloid generation, egins in its lowest state with a medusoid polyp.

Similar facts are known among Echinoderms, in which, among Criıoids, the highest free forms begin with germs provided with a stem, hus assigning, on embryological grounds, a lower position to all hose which are provided with a stem.

In the same manner has it been possible to determine the position f Bryozoa among Mollusca below Ascidiæ, upon the ground that heir embryonic development is similar. It has been possible, in the ame way to assign to Pteropoda a position inferior to that of Gasteopada proper, and not intermediate between Gasteropoda and Cehalopoda, as anatomical investigations would seem to indicate. For t is now plain that the spreading appendages of the body of Pteroooda are not analogous to the long tentacles which encircle the head n Cuttle-fishes, but correspond to the vibratory rudders of the mbryo in marine Gasteropoda.

Again, the position of Foraminiferæ, seems to me no longer doubtul. They are neither microscopic Cephalophoda, nor Polypi, as of ate it has been generally thought best to consider them, but contitute a truly embryonic type in the great division of Gasteropoda, exemplifying, in this natural division, in a permanent condition, the mbryonic state of development of common Gasteropoda, during which the bulk of the yolk passes through the process of repeated livisions.

This principle—of embryological changes as a foundation of the

natural classification in the internal arrangement of all the minor groups in the natural classes of the animal kingdom—applies, with equal success to the vertebrata.

We need only contrast the successive changes of tailless Batrachians during their metamorphoses, with the permanent forms of the caudate and branchiate types in that order, to be satisfied that the relative rank of all these genera can in no way be better determined, than by a direct comparison of the permanent forms of the whole group, with the successive changes in the embryonic condition of its higher types; and a comparison of the metamorphoses themselves, in the different genera, will leave no doubt as to which of them the highest rank should be assigned.

I have already, on other occasions, alluded to the improvements which are likely to be introduced into our classification of birds, upon considerations derived from embryological data. I may be permitted here to add, that even the classification of mammalia will receive decided improvements upon the consideration of their embryological changes. A single instance, even now, will at least show that the true relative rank of their families can be determined in that way. We need only compare, among true Carnivora, the Plantigrades, the Digitigrades, and the web-footed Seals, with the transformation of the limbs in the embryo of Cats and Dogs, to be satisfied that the order in which these animals are arranged by CUVIER, does not agree with their natural metamorphoses, and that the Plantigrades should rank below the Digitigrades, nearer to the Seals, and the Digitigrades highest; and the affinity of the Ice-Bear to the Seals will further sustain this statement.

These remarks will, at the same time, show that no investigations are at present more needed to improve our natural methods in classification, than a thorough study of young animals; and that an extensive illustration of the young of all the principal representations of the great natural groups in the Animal Kingdom, would, for the present, contribute more to the advance of Zoology, than any amount of description of new species.

But these investigations of young animals should be made with a full knowledge of their various relations, and with the view of ascertaining chiefly those Zoological peculiarities, which may illustrate more fully the value of all these relations.

There is another field of investigation hardly yet entered upon, which is likely to contribute largely to the improvement of our

classification. I refer to the study of fossils, compared in their structural peculiarities, with the embryos of their living representatives. It has already been shown that many fossils of the earliest geological periods have a close resemblance to embryonic forms of the present day; and that, in their respective families, these fossils rank among the lower types.

This result, in itself, should be a sufficient inducement to trace this double relation, and to ascertain from as many fossils as possible, whenever they are sufficiently well preserved to allow of such comparisons, what is the extent of their analogy to embryonic forms, of the present period, and also what is the amount of affinity they have to the lower types of their respective classes.

I would mention in this connection, the necessity of a revised comparison of the Trilobites, with the earliest stages of development of Crustacea, when it will be found, as I have already seen it, that almost all the genera of Trilobites seem to be the prophetic images, in a gigantic form, of the different types the Crustacea present in their embryonic state. The different degrees of development of these different types, when contrasted with each other, will go far to assign to each genus, its appropriate rank. I venture even to say, that the time will come when the relative age of fossils, within certain limits, will be as satisfactory a guide in assigning them their normal position in a natural system, as the facts derived from the study of their structure, so intimate are the connections existing between all parts of the wonderful plan displayed in creation.

Little or no advantage has as yet been derived from the study of the relations of animals with the elements in which they live, in ascertaining their natural relations among themselves; but even in this respect we may derive valuable hints from a careful study of the geographical distribution of all animals; and the mere nature of the elements in which they live naturally.

On reviewing lately the whole Animal Kingdom, with a view to ascertain what is the value of the natural connection between the animals and the media in which they live, with reference to organic gradation, I have satisfied myself that aquatic types are decidedly inferior to the terrestrial; the marine inferior to the lacustrine and fluviatile ones; that those which live upon the main land and burrow under ground are inferior to those which live above ground; that nocturnal types are inferior to diurnal types; and that under otherwise similar circumstances, representatives of one and the same

group which differ in these respects, have a higher and lower rank, in accordance with their external circumstances; so much so, that where we have no other guide, an influence respecting their natural position may be fairly derived from their conditions of life.

It will thus be obvious that as soon as we introduce simultaneously into our classification considerations derived from all these different sources; as soon as we allow the embryonic development, geological succession, geographical distribution, and relation to the natural elements, to assist us in our efforts to assign to all animals a natural position in one great system, we shall be able to sketch a far more complete picture of the great diversity which exists in nature, than if we allow ourselves to be guided chiefly by anatomical data; and my object at present is mainly to urge the necessity of studies in these different directions, with a view of improving our classification, and to insist upon the necessity of keeping, at the same time, in view, all these facts, whenever we attempt to form a correct idea of the manifested relations which exist throughout the creation, from the earliest period of the existence of animals up to the present day, between all their different types.

The Association then adjourned to meet to-morrow, at 10, A. M.

LEWIS R. GIBBES, *Secretary.*

Fourth Day, Friday, March 15, 1850.

MORNING SESSION.

Prof. Bache took the Chair at half-past 10; the minutes of last meeting were read and confirmed.

The Report of the Standing Committee was read, and the following resolution offered:

Resolved, That the following named members of the Association be requested to report at the next meeting, at New-Haven, the Physical Constants for the following places:

1. Philadelphia—Prof. Frazer.
2. Cambridge and Boston—Prof. Lovering, Prof. Pierce.
3. Charleston—Prof. L. R. Gibbes.
4. New-Haven—Prof. Olmsted, Mr. E. C. Herrick.
5. Cincinnati—Prof. Mitchell.

The resolution was unanimously adopted.

The following gentlemen, nominated by the Committee, were elected members of the Association:

Dr. A. B. Williman, Dr. Henry Ravenel, Charleston, S. C.; John Muzzey, Esq., Portland, Me.; Rev. George White, Marietta, Ga.; Prof. Sherman, Howard College, Ala.; Dr. Pendleton, Sparta, Ga.; Dr. Andrews, Charlotte, N. C.; George A. Trenholm, Esq., Henry D. Lesesne, Esq., Charleston, S. C.

A recess at 1 o'clock was recommended, and the Programme for the day announced.

Dr. Bachman was called to the Chair, and the reading of papers commenced. Dr. B's. own paper coming up first, he requested Prof. Shepard to take the Chair, while he read a paper

On the American Species of the Genus Putorius, by John Bachman, D.D., *Professor of Natural History, College of Charleston.*

[Not received.]

Dr. Bachman resumed the Chair, and Prof. Tuomey read a paper, *On the alleged subsidence of the Coast of South-Carolina*, which has not been received.

The next paper presented was the following:

An examination of the Physical History of the Jews, in its bearings on the Question of the Unity of the Races; by JOSIAH C. NOTT, M.D., Mobile, Ala., *of which the following is an abstract.**

HAVING assumed as a fact generally conceded (all things being equal) that those races of men or animals, which are least mixed with others, preserve best their original types, the following propositions were laid down for examination:

1st. That from the time of the Patriarch Abraham to the present, the Jewish race has preserved its blood more pure than any of antiquity, whose history is known to us; and that consequently its original type *ought* to be the same, as its type of the present day.

2d. That we have abundant evidence to prove that the original type brought by Abraham from Mesopotamia, 4000 years ago, *has been* substantially handed down to his descendants of the present day.

3d. That although the Jewish race has been subjected during this immense lapse of time, in the four quarters of the globe, to every possible variety of moral and physical influence, yet in *no instance* has it lost its own type, or approximated that of other races.

4th. And lastly, this race having thus for 4000 years preserved its type unchanged, under all known influences which could change a race, it follows as a corollary that no physical causes exist which can transform one race into another, as the white man into the negro, etc.

Dr. NOTT admitted that much talent, learning, and industry had, at various times been brought to bear on the subject before us, but insisted on the necessity of another and full investigation, as more perfect *data* for its clear understanding have been accumulating in the last 20, than have existed at any previous time during 2000 years. The inscription on the monuments of Egypt especially, which have only recently been deciphered, have opened an entirely new field. We now have positive facts to prove, from this source, the distinctness in type of Asiatic and African races, some 2 to 3000 years before Christ, and a well established chronology for remote ages, utterly unknown, previous to the discoveries of CHAMPOLLION and his followers. He then glanced at the evidences afforded by the Book of Genesis, of the antiquity and permance of the peculiar features presented by the Jews of our day.

* The reader is referred to the "Biblical and Physical History of Man," by the same author, for further details.

Abraham, the great Patriarch of this race, is a direct descendant from Shem, the son of Noah, and only ten generations below him. According to the Hebrew text, the epoch of Abraham was but 292 years after the flood,* and about 2000 years B. C. He doubtless preserved the type of his ancestors, through these comparatively few generations, and facts go very strongly to show, that the linaments of Father Abraham have been faithfully transmitted to our day, through some 125 generations. We have never seen the fact disputed that the modern Jews, as we see them in Europe and America, are faithful representatives of their early progenitors, and yet such strange grounds have been taken by certain writers, as to the influences of physical causes on mankind, as to render it necessary that it should be established on a firm basis.

The native land of Abraham was "Ur of the Chaldees" (Mesopotamia) where he married Sarah, one of his own race—with her he moved to the land of Canaan, which was promised to him and his posterity by the Lord. When his son Isaac and grandson Jacob arrived at marriageable ages, wives were brought for them from the land of their forefathers, and from their kindred; and we have thus the most clear Biblical evidence that up to the time of the entrance of Jacob and his twelve sons into Egypt, the blood of the Israelites, as well as their type was faithfully preserved. By the invitation of Joseph, they migrated to Egypt, about seventy in number, and the land of Goshen was assigned them as a residence. It was adapted to their pastoral habits, and was detached from the Egyptian population. They lived in this country, we are told, through but four generations, and the duration of time has been variously estimated at from 215 to 430 years, but they lived apart from other people, and intermarried only amongst themselves.

The next steps in the history of this people were the memorable Exode under Moses, the Conquest of Canaan, by Joshua, and their settlement in that country, and from this period down to the destruction of the Temple by Titus, A. D., Palestine was more or less occupied by them—a period of about 1500 years. It is true that during this time they were incessantly harrassed by wars, civil and foreign—were subjected to captivities and calamities of various kinds; and their blood was somewhat adulterated with that of the Syro-Arabian stocks around them, who did not differ greatly from them in

* The Septuagint version places it 1072 years after the Flood.

type, in a few instances, as Solomon, Joseph, and others, they married Egyptians. It is clear, therefore, from the history of the Jewish people from, first to last, but more especially since the Babylonish Captivity; as well as from their rigid adherence to this custom all over the world, at the present time that the Israelites have preserved, in a remarkable degree, their purity of blood, and as a consequence, their linaments. There have been, as we have stated, exceptions to the broad rule, which *will account for the deviations of type*, not unfrequently seen amongst those professing the Jewish faith; and while on the one hand, we can thus account for those deviations from the national type, we on the other, never doubt as to the origin of a Jewish face wherever we meet it. A well-marked Jewish face is never seen out of the Abrahamic race; and this fact alone should almost suffice to prove that the features of the Patriarch, and through him that of the ten generations before him have been faithfully perpetuated.

But what other evidence have we of this transmission of type from early times? Even the dead, who have been sleeping in their tombs for 3 or 4000 years, have risen up to testify to the fact! In the magnificent collection of Dr. Morton, in Philadelphia, may be seen the mummied head of an Israelite taken from an ancient Memphitic tomb, in which the national type is so perfect that it would be pronounced in our day, a characteristic specimen of the race. This head is the more striking, as it is one of more than one hundred from the same source, sent out from Egypt by Mr. Gliddon, &c., stands in strong contrast with others of Egyptian, Pelasgian, Negro type, &c. Other specimens of Jewish type are found in the Catacombs.

On the ancient monuments, too, of Egypt, we see sculptures, and paintings of different Asiatic and African races, as distinctly marked as at the present day, dating back, according to Bunsen, Lepsius, &c., from 1500 to 3000 years Before Christ, and amongst others, it is conceded generally, that there are portraits of Israelites, ante-dating the epoch of Moses. (See *Rosellini*, *Hengstenberg*, *Osburn*, *Kitto*, etc.) The Rev. Dr. Hawks, of New-York, in his late interesting work on Egypt, endorses fully this opinion.

It is remarkable too, how these testimonials of antiquity are corroborated by the statements of modern travellers in all parts of the world. The identical features presented by the Jews all over Europe and America, are still found in Mesopotamia, their original abode,

between the waters of the Tigris and Euphrates, also, through northern Persia, Afghanistan, &c., a direction in which we are informed by history sacred and profane, the ten tribes were dispersed after the Assyrian captivity, in the 8th Century, B. C.

The final dispersion of the remaining tribe took place in the year 70, A. D., and since that time, this people have been scattered over the habitable globe—have adopted the languages, manners, customs, and modes of life of the nations among whom they have settled, in all latitudes, longitudes, and climates; and yet no one ever looks to climate, or any other cause but the blood of Abraham, to account for the Jewish features. It is true that all races of men are more or less influenced by the extremes of climate—the Jews, like other fair races, become more fair in cold, or more dark in hot latitudes, than in their native land; yet there is a limit to this change, and that limit is far short of other types—the complexion may be bleached or tanned in *exposed* part of the body, but the pure blooded Jew has never changed his lineaments.

We are fully aware that PRICHARD,* (who is inconsistent with himself on this and numerous other points,) contends that Jews *have*, in various parts of the world, been transformed into other types, and several examples have been brought forward by himself and other advocates of Unity of the Races. We have examined them all with care, and have no hesitation in saying that they have not the slightest foundation in truth—nor is there a single instance of transformation of any race in PRICHARD's book, which cannot be refuted from his own writings.

The most prominent example, and one hawked about by every periodical scribler is that of the *Black Jews* of India, respecting which Mr. PRICHARD has dodged the difficulties opposed to him in a most extraordinary manner, for one professing to write the "Physical History of Mankind." Though the testimony is *certainly* strong, not to say *conclusive*, to prove that the so called *Black Jews* are in reality *not Jews*, he suppresses the facts entirely, and passes it over without assigning a reason for his assertion, and with the simple statement that there is "no evidence" to show that they are *not Jews*.

DR. NOTT here introduced at some length quotations from Rev. CLAUDIUS BUCHANAN, WOOLFF, and others, conversant with the facts—

* We are prepared to show that no book in the language, contains more false facts and forced conclusions, than PRICHARD's celebrated work on Mankind.

the most reliable evidence (all of which was well known to PRICHARD) to disprove his assertion. A reference to the Asiatic researches of BUCHANAN will satisfy the reader—he visited Malabar under the protection of the British authorities, and spent some time amongst the *White* and *Black Jews*, in 1806–7–8, and the following is a short extract from this work.

"The "Jerusalem or *White Jews*," live in *Jews-town*, about a mile from Cochin, and the "*Ancient* or *Black Jews*," with small exceptions, inhabit towns in the interior.

"On my inquiry into the antiquity of the *White Jews*, they first delivered to me a narrative in the Hebrew language, of their arrival in India, which has been handed down to them from their fathers, and then exhibited a brass plate, containing their charter and freedom of residence given by the King of Malabar, &c."

The narrative states that they migrated after the destruction of the second temple, to India. The King of Malabar granted them lands in A. D., 490, and this grant, according to custom, was engraved on a brass plate, which they still had in possession. He further states that the native annals of Malabar, confirm these, and many other details, which will be found in the work alluded to. The Mahomedan histories of later ages also support these facts.

Of the *Black Jews* he says: "Their Hindoo complexion and their very *imperfect resemblance to the European Jews*, indicate that they have been detached from the parent-stock in Judea, many ages before the Jews in the West, and that there have been intermarriages with families *not Israelitish*. * * * * The White Jews look upon the Black Jews as an *inferior race*, and as *not of pure caste, which plainly demonstrates that they do not spring from a common stock in India.*"

It will be thus seen that the testimony of Dr. BUCHANAN, than whom there can be no more competent or reliable authority, leaves no reasonable ground to doubt that the White Jews had been living at least 1500 years in Malabar, and were still *White Jews*, without any approximation to the type of the Hindoos, and that the Black Jews are an "*inferior race*"—"not of pure caste," or, in other words, adulterated with dark Hindoos. This testimony is confirmed by WOOLFF, in his Missionary Researches, who also travelled in India; and we know of no opposing evidence of weight. The Black Jews are probably a portion of the ten tribes who wandered off, and, like the others, as before stated, have mingled with other races.

How, let us ask, could Mr. PRICHARD pass over such evidence, and without one word to rebut it, and say there is "no evidence" that the Black Jews are not pure? How, too, can he acknowledge, as he, and as every body must, that the White Jews have been living in the same climate for at least 1500 years without change, and yet contend that the so-called Black Jews, though repudiated by their white neighbors, are really pure Jews. If 1500 years, which would give about fifty generations, cannot produce amongst the White Jews any approximation in type to their Hindoo neighbors, can any one contend that 2500 years would so completely transform them?

The Jews of Abyssinia have also been instanced as an example of change; but Dr. NOTT here introduced some striking facts to the contrary, from an interesting pamphlet by the distinguished orientalist, CHAS. T. BEKE, Esq., London, respecting this people, showing clearly that they are not of pure blood. BRUCE, though inclined to the opinion that they are pure Jews, expresses doubts; while PRICHARD himself supports the opinion of BEKE.

The history of the *ten tribes* affords strong evidence of the influence of mixtures with other races. In the 8th century, (B. C.) they were conquered by Tiglathpileser and Shalmaneser, and carried captive into Assyria, and their places supplied by foreign colonists from that country. These, with the remains of the ten tribes, formed the Samaritans of after times, while the great mass of these tribes were scattered across Asia and almost lost by amalgamation. This seems to be the plain teaching of sacred and profane history, and yet the uninformed are discovering them, not only in the remote corners of the old but in the New World. The aborigines of America have been taken for the *lost tribes*, and California for the land of Ophir—both ideas equally ridiculous. We cannot imagine, if all other testimony were wanting, how these tribes should have lost all traces of their religion, and even their family names, to say nothing of their type!

The following extract from the *Encyclopædia Britannica*, will be found interesting in connection with this subject:

"The Afghans, as before remarked, bear strong marks of Jewish type, and are doubtless descended from the ten tribes." "The Afghans have no resemblance to the Tartars who surround them, in person, habits or language. Sir WILLIAM JONES is inclined to believe that their descent may be traced to the Israelites, and adds that the best informed Persian historians have adopted the same opinion. The

Afghans have traditions among themselves, which render it very probable that this is the just account of their origin. Many of their families are distinguished by names of Jewish tribes, though, since their conversion to the *Islam*, they conceal their descent with the most scrupulous care; and the whole is confirmed by the circumstance that the *Pushto* has so near an affinity with the Chaldaic that it may justly be regarded as a dialect of that tongue. They are now confounded with the Arabs."

Here again we have strong evidence of the permanence of type. These tribes were carried off captive in the eighth century B. C., or about 2600 years ago; they have been persecuted to the last degree, and their blood greatly adulterated, and yet "in person, in habits, in language," etc., they still show their Hebrew origin.

Though the object of Dr. Nott was simply to give a sketch of the physical history of the Jews, as illustrative of that of the whole human family; yet the *Gypsies*, in their history, present such curious analogies with the Jews, that he could not resist the temptation of offering a few passing remarks on this singular race. In the language of Borrow, who has seen much of them, written much about, and who spoke their language, "both had an exode—both were exiles, and dispersed amongst Gentiles, by whom they are hated and despised, and whom they hate and despise; both possess a peculiar countenance, by which they may, without difficulty, be distinguished from other nations; but with these points the similarity terminates. The Israelites have a peculiar religion, to which they are fanatically attached—the Gypsies have none; the Israelites have an authentic history—the Gypsies have no history, and do not even know their original country."

Though the history of this people is involved in obscurity, it is conceded, from their language, their physical type, etc., that they came from India, where similar wandering tribes are still seen in certain parts of that country; but how long they had been detached from other tribes, while there, or at what time, and by what route, they migrated, are still matters of doubt. Borrow thinks, and gives good reasons for the opinion, that they *may* have been wandering in the North, amongst the Slavonic races, before they come within the reach of our history. By many it is believed that they fled before the exterminating sword of Tamerlane, who ravaged India in 1398–'9. But, be all this as it may, it is certain that a few years after this date they first appeared in Germany, and were soon scattered all over

Europe. Their entire number now is estimated at about 700,000, and they are scattered over Asia, Africa, Europe, and even South America. They are seen in Russia, living in open tents where the thermometer is 25° and 30° below the freezing point; they are found in the torrid zone, and in all intermediate latitudes.

Thus we see the Gypsies scattered, for at least 450 years, through all climates, and amongst all nations—exposed to want, misery and suffering in every shape—subjected, in the highest degree, to all those physical causes which are said to change races, and yet, like the Jews, retaining their peculiar type, habits, customs, and even peculiar language. Unlike the Jews, they have never taken part in the march of civilization, but have every where kept themselves isolated. Like the Hindoos, they have much smaller heads than the Hebrews and other white races, and their lives and characters have been the result of an inferior organization, which they received from the Almighty. Intellectual activity and progression belong to the very nature of the Jewish race—intellectual quietude and dislike for change belong to the Hindoo races.

Though, by their mode of life, exposed to all those hardships which destroy beauty in the white races, in both old and young, BORROW tells us this race "is, by nature, perhaps, the most beautiful in the world; and among the children of the Russian Gypsies are to be found countenances, to do justice to which would require the pencil of a Murillo." Their great hardships, however, destroy their beauty early, and they often become extremely ugly in age.

The Magyars, who played such an important part in the recent Hungarian struggle, might be cited as another example of preservation of type. They belong to the great Tartar subdivision of the Caucasian family, and detached themselves about the year 880, A.D. (1000 years ago,) from their Asiatic connections, advancing into Europe under their chief Arphad. There are now in Hungary about 3,500,000 of this race; and we here see them still preserving their original type in one of the finest portions of Europe, where the fairest skins of Teutonic type flourish in perfection.

But it does not enter into the design of this paper to bring before you a tithe of the examples of permanence of type, or to show how little historical evidence can be found to sustain the supposed instances of change of type, which have been brought forward by the advocates of a common origin for all the races of the globe. Enough has been said to satisfy any unprejudiced mind that the Jewish race, from the

time of Abraham to the present, through more than one hundred generations, has preserved its type, and, *a fortiori*, for the ten generations between him and Noah. The evidences of other types equally well marked as the Hebrews, and contemporary, or even antedating the remotest gleam of Hebrew history, will be reserved for another occasion—China, Egypt, America, etc.

Much confusion has been thrown into the natural history of man by the introduction of arbitrary classifications, and terms to designate certain groups of races, as Caucasian, Negro, etc., which have no foundation in nature. It has been assumed, without a particle of proof, that each of these groups has a common origin, to say nothing of unity for *all*. There is abundant reason for the opinion that several types have been included under each of these terms. We certainly have no chronology, sacred or profane, which will allow us to compress all the so-called Caucasians—viz: Egyptians, Hebrews, Hindoos, Persians, Celts, Slavonians, Teutonic families, Tartars, etc.—into one origin; and so with the endless types among the dark-skinned races of Africa, etc.

The writer regarded the subject of ethnography not merely as a link in the chain of science to amuse the curious, or to furnish analogies to light other investigations, but as one of great practical importance in its bearings on the future destiny of races.

Dr. Nott here alluded to the fact, which will not be denied, of the superior intelligence of the Mulattoes, when compared with the pure negroes. The pure blacks, when left to themselves, have never been able to sustain a rational form of government, and in Hayti barbarism advances as the white blood is expelled.

He closed by saying that though he looked with deep interest at the experiment now making in Liberia, as the last hope of the Negro race, he could not but predict, and that, too, with painful confidence, its utter and speedy failure. This colony now is sustained solely by the support which it receives from the whites without, and by the white blood coursing through the veins of their leaders at home. President Roberts is "three-fourths white blood, with florid skin, red hair," etc., and, with one or two exceptions, all those who have figured in Liberia are Mulattoes.

After the abstract of Dr. Nott's paper was read, Prof. Agassiz rose and remarked that he would take this opportunity to correct some mis-statements, or at least misapprehensions of his views, on

the subject of the Unity of the Human Race, or rather with regard to the diversity of the different races of men. He said that he regarded all the races of men as one in the possession in common, of all the at-attributes of humanity; as one in the possession of moral and intellectual powers, that raise them above the brutes, and by which they are allied to the Deity; as one in the hope of eternal life through the means pointed out by revelation. In all these characteristics, though exhibited in very different degrees, he had never denied that they constituted one brotherhood. But, viewed zoölogically, the several races of men were well marked and distinct. That in the geographical distribution of animals, there could be shown to be distinct zoölogical provinces, each characterized by its peculiar Fauna, and that therefore animals did not originate from a common centre, nor from a single pair, but according to the laws which at present still regulate their existence. That the principal races of men in their natural distribution, cover the same extent of ground as these zoölogical provinces, and that this fact, as well as others that might be mentioned, tends to prove that the differences we notice at present between the races were also primitive, and that these races did not originate from a common centre, nor from a single pair. That among the facts corroborating this view, was the permanence of the difference between the Caucasian and the Negro, the degree of this difference being as well marked in the remotest times as at present, as was proved by ancient records and monuments, as for instance those of Meroë. He maintained that this view, though opposed to that generally held, did not militate against the teachings of Scripture History, since he regarded it as expressly declaring, that as early as the days of CAIN, there were other lands already peopled, in which the wanderer took refuge.

At 1 o'clock, there was a recess for fifteen minutes. After recess the Association was called to order by Professor BACHE, and the Hon. B. F. PORTER, of Charleston, S. C., nominated by the Standing Committee, was unanimously elected a member of the Association.

Dr. BACHMAN was called to the Chair, and the Association proceeded to business.

An abstract of the following paper, was read by Prof. GIBBES, to whom it had been referred.

A Microscopic examination and description of some of the Piles of the head of Albinos; by P. A. Browne, LL. D.

The word Albino, (from "Albidus," inclining to white,) is Portuguese, and was originally applied to some individuals found upon the Coast of Africa, who, though descended from negroes, had a pale, pinkey, and unnatural tint of skin, rose colored iris, and red pupil to their eyes, and soft white pile. It is now extended to all persons of whatever nation or country, who have silky, dirty, or reddish-white colored* pile, a pale reddish-white skin, red pupils, and weak sight. The number of these individuals is not great. Van Amringe† computes that they do not exceed one in a million of the inhabitants of this earth, yet Dr. Prichard treats them as *a distinct race.* In his researches on the physical history of man, he divides the human family into the Melanic, or black-haired race; the Xanthous, or yellow haired, and the Albino, or white-haired. We shall see in the sequel what ground there is for this latter distinction.

No. 1. Examination and description of the pile of the head of the white Albino, Mary McWilliams, aged 25, born in Ireland. Specimen presented by Dr. Klapp, of the Pennsylvania Hospital, in the city of Philadelphia, the 22d of March, 1849.

Length, (artificial) four inches.

Shape, oval, compressed, tapering, for example, a young filament, one inch, long, has for its diameter, at the lower extremity, 1-416 by 1-200, in the centre 1-625 by 1-312, and at the apex, 1-5000 of an inch.

Color, white, with a slight tinge of yellow.

Lustre, considerable.

Direction, flowing.

Inclinations, I have no means of ascertaining.

Ductility, Elasticity, and Tenacity.

One inch of filament, the Barometer being 39, the Thermometer being 72, and the Dew Point being 68.

* What is generally denominated *grey* hair is *colorless.*

† In History of Man, p. 71.

With 170 grains stretched 1-90 of an inch, and when the weight was removed the elasticity was entire.

With	220	grains	stretched	2-90	of an inch,	elasticity entire.		
"	270	"	"	4-90	"	minus	1-90	of an inch.
"	320	"	"	5-90	"	"	1-90	"
"	470	"	"	6-90	"	"	1-90	"
"	520	"	"	7-90	"	"	1-90	"
"	570	"	"	10-90	"	"	2-90	"
"	620	"	"	31-90	"	"	13-90	"
"	670	"	"	35-90	"	"	17-90	"
"	720	"	"	40-90	"	"	22-90	"
"	770	"	"	44-90	"	"	25-90	"
"	820	"	"	47-90	"	"	33-90	"
"	870 it broke.							

Fracture abrupt.

Button, *Sheath*, and *Follicle*, I had none to examine.

Shaft, uneven, bulged, flattened, and sunken in different places.

Cortex transversely striated the whole length of the shaft; Ribbons of cortex, artificially detached from the body of the shaft, exhibit transverse divisions, the largest portion measuring 1-281 of an inch.

Intermediate Fibres, white, lustrous, and with a diameter, of from 1-2500 to 1-5000 of an inch. The mass of fibres divided into sections or nodes, when the shaft is crushed by passing it between rollers, these fibres are distinctly seen; they are white, lustrous and partially separated, but no canal or coloring matter is to be observed through the interstices.*

Centre has a canal for the conveyance of the coloring matter, which is greenish white, opaque and interrupted. When the cortex and intermediate fibres are artificially made transparent, the coloring matter is seen collected in spires and tangled threads, of a dead plumbeous color, interrupted by vacant spaces in the canal.

Apex, very pointed, none furcated.

Disks or transverse sections, plumbeous colored, with sometimes a minute central speck, which is white and opaque.

No 2. Examination and description of the pile of the head of the

* The same experiment was tried upon the other specimens, and the same result ensued; but when the wool of a pure Negro, or the black wool of Sheep, was similarly treated, the fibres were black.

head of the white Albino. JAMES SPENCE, Esq., of Philadelphia, aged 21, whose father had brown and whose mother had black hair. Specimen presented by himself. in 1849.

Length, (artificial) two inches and a half.

Shape oval, 1-458 by 1-937 of an inch. Tapering, for example, a young filament, one inch long, measured at its lower extremity 1-279, in the centre, 1-364, and at the apex, 1-2500 of an inch.

Color, white, with a very slight tinge of straw color.

Lustre, considerable.

Direction, flowing.

Inclination, at an acute angle to the epidermis.

Ductility, Elasticity, and Tenacity.

The Barometer, Thermometer, and Dew Point being the same as before stated, one inch of filament.

With	170 grains	stretched	1-90	of an inch.	Elasticity entire when the weight was removed.
"	400	"	"	2-90	"	"
"	520	"	"	3-90	"	"
"	670	"	"	4-90	"	"
"	725	"	"	10-90	"	minus 4-90
"	970 it broke.					

Fracture abrupt, a small portion of the cortex being abraded.

Button.

Sheath.

Follicle.

Shaft uneven, bulged, flattened and sunken.

Cortex, transversely striated the whole length of the shaft; the striæ numerous.

Intermediate Fibres. Having artificially removed the cortex, the intermediate fibres are exposed to view; they are divided transversely into sections or nodes of the following lengths, viz: 1-137, 1-125, and 1-250 of an inch. The interstices are bands which are originally white, but which, by exposure to the atmosphere, turn dark coloured.

Central Canal. Upon artificially rendering the cortex and intermediate fibres transparent, the colouring matter is seen, consisting of portions of unequal sizes, of spires or threads of a plumbeous colour. The mass has a diameter of 1-2500 of an inch, but the threads are too small for measurement.

Disks, or transverse sections shew a plumbeous colour either continuous or with a minute central speck.

No. 3. Examination and description of the pile of the head of the black Albino Boy, ten years old, both of whose parents are black. Specimen presented by Dr. NOTT, of Mobile, Alabama.

Length, (natural) one inch and two tenths.

Shape, eccentrically elliptical, diameter 1-264 by 1-625 of an inch. Tapering, for instance, a young filament measuring one inch and two-tenths, had the following diameters, viz: at the lower extremity 1-625 in the centre 1-937, at the apex, 1-1250 of an inch.

Color, dirty reddish white.

Lustre, none.

Direction, crisped and frizzled and spirally curled. Diameter of the curls 2-10 of an inch.

Inclination. I have no means of ascertaining.

Ductility, *Elasticity* and *Tenacity*.

One inch of filament, the Barometer, Thermometer and Dew Point being as above stated,

With	160	grains	it stretched	1-90	of an inch,	elasticity entire.
"	470	"	"	2-90	"	"
"	570	"	"	3-90	"	"
"	670	"	"	4-90	"	"
"	820	"	"	5-90	"	"
"	870	"	"	6-90	"	"
"	920	"	"	10-90	"	"
"	970	"	"	15-90	"	minus 3-90 of an inch
"	1020	"	"	17-90	"	5-90
"	1070	"	"	20-90	"	10-90
"	1220	it broke.				

Fracture splintery.

Button hooked, knotted, and otherwise distorted. One of them besides the main root had two others of smaller dimensions.

Sheath large, white, opaque and sometimes divided.

Follicle have none to examine.

Shaft uneven, bulged, flattened and sunken.

Cortex striated, striæ sometime intersecting at right angles.

Intermediate fibres white and lustrous; diameter of one of the smallest 1-2500 of an inch.

Central Canal, with detached portions of plumbeous colored spires, or threads of coloring matter. The greatest dimensions

of a mass 1-2500 of an inch; the threads too minute for measurement.

Apex pointed, furcated or brushy.

Disks plumbeous color throughout.

No. 4. Examination and description of the pile of the head of black Albino boy, of Cape May, New-Jersey, aged 12 years. Specimen presented by Mrs. Garwood. His father is black and his mother a dark mulatto; they have five children, of whom three, viz: two males and a female are Albinos, the other two are black and have negroes wool.

Length, (natural,) 2 inches and 1-10th.

Shape, eccentrically elliptical with a diameter of 1-416 by 1-937 of an inch. Tapering, for example, a young pile measuring 2 and 1-10 inches, had at its inferior extremity 1-281,—in the centre 1-364, and at the apex 1-1250 of an inch.

Color, dirty white.

Lustre, none.

Direction, frizzled and spirally curled. Diameter of the curls 1-10 of an inch.

Inclination. I have no means of ascertaining with certainty, but am informed that it is right angle to the epidermis.

Ductility, Elasticity and Tenacity.

One inch of filament, the Barometer, Thermometer and Dew Point, being as before stated,

With	160	grains it	stretched	1-90	of an inch,	elasticity entire.
"	220	"	"	2-90	"	"
"	270	"	"	3-90	"	"
"	370	"	"	4-90	"	"
"	420	"	"	5-90	"	"
"	470	"	"	10-90	"	minus 4-90
"	520	"	"	21-90	"	7-90
"	570	"	"	34-90	"	19-90
"	620	"	"	40-90	"	23-90
"	670	"	"	42-90	"	25-90
"	720	"	"	45-90	"	27-90
"	770	"	"	48-90	"	30-90
"	820	"	"	50-90	"	32-90
"	870 it broke.					

Fracture, brushy.

Button, sheath and *follicle*. I have none to examine.

Shaft uneven, bulged, flattened and sunken.

Cortex striated, striæ numerous and confused.

Intermediate fibres white, lustrous; diameter of one of the smallest 1-5000 of an inch.

Centre, a canal enclosing a coloring matter, which is white, with a slight tinge of yellow, interrupted; diameter 1-1875 of an inch. When the cortex and intermediate fibres are artificially made transparent, the coloring matter is seen in plumbeous masses of spires or threads; diameter of the masses 1-2500 of an inch, the threads too minute for measurement.

Apex very pointed,

Disks plumbeous, colored with a minute light colored speck in the centre.

I have no pile of an American Indian Albino, but notice that WAFER states that he saw many of them among the copper colored native American Indians of the Isthmus of Darien. He says that they are not a distinct race, but that they are descended from these copper colored Indian parents.*

Mr. JEFFERSON† mentions four cases of Albinos known to himself, and three others of whom he was informed, all of them descended from negro parents, with no mixture of white blood.

There are also Albinos among the lower animals, whose pile it is my intention to examine and describe at some future day.

It appears, from the foregoing examinations and descriptions—

1st. That the covering of the head of the Albinos is *pile*. Its general form and its ductility and elasticity, are sufficient to entitle it to a place in that category.

2d. That specimens No. 1 and 2, by their oval shape, flowing direction, acute inclination, and being formed of three distinct parts, one of which is a central canal for the conveyance of the coloring matter, entitle the individuals upon whom they grew, respectively, to be ranked with the oval haired species of men. But that the

* MARTIN in History of Man, &c., p. 166, says that Albinos appear among all nations; they occur among the fairest of Europe and the darkest of Africa, in Java, Ceylon, and the Continent of India. Captain COOK saw them in Ottaheite, and WINTERBOTTOM mentions having seen them at Sierre Leone, and the neighboring parts of the African Coast.

† Notes on Virginia, 139.

filaments gradually tapering from the inferior to the superior extremity,—the unevenness of surface of the shaft, and the disposition of the coloring matter in spires and threads, shew that they are a *variety* of that species.

3d. That specimens No. 3 and 4, by their eccentrically elliptical shape, crisped, frizzed and spirally curled direction, and probably by the inclination entitle the individuals upon whose heads they grew, respectively, to be ranked with the eccentrically elliptical haired species or negro. But that their gradual tapering, their unevenness of surface, and the disposition of the coloring matter in a central canal, shew that they are a *variety* of that species.

Wherefore there is no ground for treating the Albino as a distinct race, as Dr. PRICHARD has done.

The *cause* of the production of Albinos is unknown; but it is generally (and I think erroneously,) attributed to *imperfect generation*, for the pile of the black Albino is more perfect than the pile of the negro, in having a *distinct apparatus*, viz.: a central canal for the conveyance of the coloring matter.

L'HERITIER analyzed the pile of the Albino, and found therein two kinds of fat, one liquid and destitute of color and the other solid and white, like stearine. (Traité de Chem. Path.) It was, probably, the latter, which I saw under the microscope.

Mr. JEFFERSON is of opinion that the cause which produces the Albino is more incident to the *female* than the *male* sex; but he was not acquainted with a sufficient number of cases to enable him to establish such a general rule, nor is he confirmed by succeeding observers.

MARTIN, in History of Man, &c., p. 166, says that "the constitution of the Albinos is feeble." In examining the four specimens for *ductility*, *elasticity* and *tenacity*, I found that the filaments were possessed of a fair proportion of these properties, which are considered as tests of vital strength.

This author also states that their intellectual powers are often, if not always, of a comparative inferiority. I have no means of judging of the correctness of this remark.

It is said that "Albinos breeding with Albinos produce their kind, but that when bred with the ordinary race the peculiarity disappears in the descendants, breaking out however now and then, as if the tendency lurked in the blood." (MARTIN's History of Man, &c., p. 166.) This is altogether at variance with Dr. PRICHARD's notion of Albinos being a distinct race of mankind.

The next paper was given,

On an easy mode of illustrating the difference in the Velocity of Sound in different Gases, by Prof. LEWIS R. GIBBES.

SCIENTIFIC experiments may be classed in two divisions, as experiments of research, or experiments of demonstration. The former must ever take the highest rank, as their results, whether negative or positive, are additions to the domains of Science, enlarging our knowledge of the ways of God in the material world. But frequently, if not generally, these results are obtained by means of elaborate apparatus and trains of experiment, which are wholly unsuited to the purpose of demonstrating the facts in question to others pursuing the branches to which the facts in question belong. In many cases simpler modes are discovered of reaching the results, even when the same degree of exactness in the numerical expression be required; and if a moderate degree of approximation, in this respect, suffice, very easy means may be devised, in many cases, of demonstrating the fact or law in question, even to a large number of auditors at once, and must be regarded as valuable aids in scientific instruction. These considerations must be my apology for bringing before the Association the apparatus I am about to use, and my remarks thereon, in all which there is little, save the application, that can lay claim to originality. They may be of use, however, to those members who, like myself, are engaged in the duties of instruction.

To produce the sound-waves in air, or in the gas under experiment, an ordinary C tuning fork, furnished with a disc, is used, as described in Herschel's Treatise on Sound, sec. 186, and on the use of this instrument much of the simplicity of the apparatus depends. By means of the Sirène the number of vibrations it makes per second may be determined. In the one I use the number of double vibrations is 520 per second. In order to show that pipes of a certain length only will vibrate in unison with this fork, a glass tube of an inch and a quarter or an inch and a half in diameter, and seven or eight inches in length, (a cylindrical lamp-chimney will answer,) is partially immersed in a small cistern of water or mercury, which forms a bottom to the tube, and the tube elevated or depressed until it yields a clear resonance to the tuning fork held over its mouth in a state of vibration, or a plug loosely fitting the unoccupied part of the cistern may be depressed or elevated, in order to change the

level of the liquid, the glass pipe being fixed. The length of the pipe now occupied by air, vibrating in unison with the fork, may be measured or read off on a scale attached to the pipe itself. A tin tube of the same dimensions may then be made and used with that fork in all experiments where atmospheric air is concerned; that which I use with the above mentioned fork is 0.11 of a foot in diameter and 0.54 of a foot in length. If, now, one of the heavier gases, carbonic acid for instance, be conducted into this tube, (from a caoutchouc reservoir, or from the common apparatus for evolving and washing it,) it will no longer yield a resonance, and if we have recourse to the glass pipe in the cistern of mercury, it will be found necessary to depress it, and thus to shorten the column of gas introduced, to a certain point at which the resonance will be nearly, if not quite, as clear as in atmospheric air. A tin tube, constructed of the same length, will serve for future experiments. With the C fork, a tube 0.11 of a foot in diameter and 0.44 in length, will vibrate in unison when filled with carbonic acid gas. Since the unison is a consequence of the isochronism of the vibrations of the tuning fork and of the aeriform fluid in the pipe, a pulse must travel from the mouth of the pipe to the bottom, and back to the mouth—that is through twice the length of the pipe—in the time of one vibration of the fork, or over four times the length of the pipe in a double vibration—that is, in 1-520th of a second. A rough approximation may therefore be made to the velocity of sound in these two fluids: in air, the space traversed by the pulse in one second will be expressed in feet by $0.54 \times 4 \times 520 = 1123$; and in carbonic acid by $0.44 \times 4 \times 520 = 915$, the temperature of experiment being about 82° Fahrenheit. The ratio of these velocities may be compared with the ratio of the densities of the two fluids, on which they depend; for, the motive forces—that is, the elasticities—being the same, both pipes being open to the atmosphere, the velocities ought to be inversely proportional to the square root of the densities; now, the length of the tubes, which give the velocities, are as 100 : 127, and the square roots of the densities are as 124 : 100.

With other heavy gases similar experiments may be performed. For nitrous oxide the pipe for carbonic acid will answer, as the two gases have almost precisely the same density. For heavier gases the pipe must be shorter; for chlorine, for instance, about five-eighths that for air. Heavy vapors, like that of ether, may be subjected to experiment in a similar manner, by immersing the pipe, with a layer

of ether at the bottom, in water at the temperature of 100° Fahr., which will keep up a supply of vapor with the elasticity of the atmosphere; or the glass tube, with the mercurial cistern, may be used, the mercury being maintained at the same temperature.

For gases lighter than air, the pipe must be longer than air, and of course supported in an inverted position; this circumstance renders manipulation rather more difficult, yet still possible with gases of moderate levity, such as ammonia. With hydrogen, however, I have not succeeded, apparently from the difficulty with which the tuning fork commands a vibration in a pipe of the length required, about 20 inches.

In all these experiments a steady current of gas is requisite to keep the pipe full to overflowing.

In addition to the apparatus just described, I use, in order to illustrate the relation of open and stopped pipes, a pipe of tin, open at both ends, of the same diameter as the preceding, and of such length that it yields a clear resonance with the tuning fork employed. With the fork already mentioned, this length is 1.09 ft., almost exactly twice the other. To obtain the proper length I use a pipe a foot long, with a short tube of four inches fitting it closely, and sliding on the outside, by which the length of the aerial vibrating column can be altered until unison is obtained. If the velocity of sound is deduced from this length of pipe, it comes out 1134 feet, at the temperature of 82°. This can easily be reduced to the temperature of 32. For, other things being equal, velocities are as the square roots of the motive forces, and the motive forces, that is the elasticities, according to the law of expansion of aeriform bodies, are as 540 : 490 at the two temperatures 82 and 32, their square roots are as 22 : 21 nearly, and the velocity at 32 comes out 1082 feet. By reduction in the same ratio, the velocity of sound in carbonic acid at 32 will be 874 feet. In order to show that there is in the middle of the tube a nodal point or lamina, where the variation in condensation and rarefaction is greatest, a second tube of the same dimensions is used, with an aperture at the middle; this yields no resonance if the aperture is open, but sounds as clearly as the first if it be stopped with the finger. To prove that the two half columns of air are vibrating in opposition, a leaden tube three-quarters of an inch in diameter and 1.13 ft. in length, is bent round until the two terminal apertures are opposed to each other, at a distance of three-quarters of an inch, and between them the tuning fork is vibrated;

the clear resonance immediately obtained proves that each half vibrates in unison with the adjacent prong of the fork, and as these vibrate in opposition, so must the two halves of the pipe.* Pipes three times and four times the length of the standard stopped pipe for air—the first closed at one end, the other open at both ends—are used for showing that pipes may vibrate in segments. These pipes yield a clear resonance with the same fork as before, the first vibrating in three half segments, the second in four; nodal points are shown by the absence of resonance, if an aperture be opened, in the first, at one-third its length from the open end—in the second, at one-fourth the length from either end, while an opening at the middle of a ventral segment will have no influence on the resonance. Tubes of glass cut off at the proper length, open at both ends, are used for showing that the material of the pipe does not influence the unison. Beats are shown by Herschel's experiment, described in Art. 205 of his Treatise on Sound, Encyc. Metr.; two C forks being brought (by loading with wax) nearly, but not exactly, in unison with each other, and made to vibrate simultaneously over the standard pipe for air. By means of this pipe, also, can be exhibited to a number of auditors at once Dr. YOUNG's experiment, by holding the C fork over its mouth, and rotating the fork on its axis; in two positions, at right angles to each other, the resonance will be heard, and in two others intermediate between the former, it will become inaudible.

I have used this apparatus for several years past in illustrating the department of Acoustics in my annual course of lectures in the College of Charleston, and perhaps no simpler apparatus can be devised for demonstrating the points to which it is applied. If the pipes were made of brass, the sliding tube might be made to fit accurately, and adjustment to unison be easy, both in stopped and open pipes. A larger fork would maintain its vibrations a longer time, as, for example, a fork giving the octave below the ordinary C tuning fork; it would of course require pipes of double length and proportionally increased diameter.

Experiments illustrating the subject of this paper were performed before the Association by Professor GIBBES.

On an apparent anomaly in Algebra; by CHARLES E. WEST, *Rutger's Institute, New-York.*

* This experiment is given by Mr. ADAMS in one of the volumes of the Proceedings of the British Association.

Prof. Agassiz, before proceeding with his paper on the Medusæ, presented to the Association his recent work on Lake Superior, with a narrative of the tour, by J. E. Cabot, just issued from the press.

On the Morphology of the Medusæ; by Prof. Agassiz.

Since it has been ascertained that the Medusæ pass through different forms in their various metamorphoses, and that their changes are further complicated by an alternation of generations, it is a matter of importance to learn how far the Polypoid stems from which free Medusæ arise, are themselves allied to Medusæ, or to Polypi. As long as the so-called Hydroid Polypi were supposed to be perfect animals, propagating themselves under the same forms, it was natural from their general appearance that they should be considered as a peculiar type among Polypi, and that the question of their structural relations to Medusæ should not even be raised. But now it is a matter of the first importance to ascertain whether in this Polypoid form, their structure is more closely related to Medusæ than to Polypi, and whether their relation to Polypi is merely analogical, and not truly structural. I have investigated this subject at some length, and satisfied myself that even in an anatomical point of view, the so-called Hydroid Polypi should be referred to the class of Medusæ, and that their resemblance to Polypi is simply the result of a close analogy, and not of true affinity, as the Morphology of their parts indicates a very close affinity to Medusæ.

In order to appreciate fully this statement, it is necessary to remember that true Polypi have a distinct digestive sac hanging into the large main cavity of the body, and that this cavity is sub-divided into more or less distinct compartments by partitions projecting inwardly. Again, the tentacles arise from the upper margin of the main cavity, and are, in no instance, appendages of the margin of the mouth. In Medusæ, on the contrary, the main cavity is undivided, and where there is a peripheric prolongation, it assumes the shape of circumscribed tubes, penetrating into the substance of the body. Again, the tentacles are, at least, of two kinds, those which arise from the margin of the body, and others which are prolongations of the margin of the mouth.

If, with these facts before our minds, we now attempt a comparison of the so-called Hydroid Polypi, with either Medusæ or true Polypi, we shall find, in the first place, that the main cavity in

Hydroid Polypi, is not divided by radiating partitions into distinct compartments, as is the case in true Polypi, and that their buds at least, if not the main cavity of the system, have radiating tubes arising from the digestive sac and following the walls of the main cavity. But what is more striking and characteristic in Hydroid Polypi, is the circumstance that the main bulk of the body is constantly well circumscribed, and its margin or surface provided with peculiar tentacles, while the proboscis or mouth assumes various forms, projecting sometimes in the shape of a moveable tube, or in the form of a prominent tubercle with a central oral opening, encircled by a row, or several rows of peculiar tentacles or fringes. These oral appendages may be compared morphologically to the fringed lobes arising from the margin of the mouth in true Medusæ, while the tentacles of the margin and surface of the body bear the closest resemblance in position and relations to the tentacles arising from the margin of the disc in true Medusæ.

In these respects, therefore, the Hydroid Polypi are more closely allied by structure to true Medusæ than to Polypi, and their resemblance to Polypi is chiefly derived from the elongation of their verticle axis, the development of a peduncle of attachment, and the formation of buds which remain attached to the main body, and give it the appearance of a branching Polypi, while true Medusæ are from the beginning of their independent development, free moving animals. But it has been already ascertained in so many families, among Echinoderms as well as among Polypi, that there are types attached by stems, and others which are entirely free, notwithstanding their closest structural relations. That this fact can be no objection, but on the contrary an argument in favor of the view, that Hydroid Polypi, with their medusine structure, should be considered as true Medusæ, provided with a stem, rather than a peculiar family among Polypi, and even should there be among them forms which never produce free Medusæ, as soon as they present those peculiar combinations of character, which occur only among Medusæ, we shall be inclined to remove them from Polypi, and to place them among true Medusæ. The medusoid character of the crown in Tubularia is particularly obvious, and it requires little familiarity with the different forms of Medusæ, to feel satisfied that the inner prominent cylindrical bulb which projects above the crown of large tentacles, and is provided on its summit with another row of shorter tentacles, is truly analogous to the central proboscis of many discoid

Medusæ, such as Gorgonia and Sarsia, while the large tentacles around the central cup corresponds to the marginal tentacles of Medusæ. The stem itself is analogous to the short stem, by which the bulb of young Medusæ is connected with the Hydroid Polyp from which they arise. This analogy further sustains the view that Hydroid Polypi are true Medusæ, inasmuch as here we have a crown of medusoid structure resting upon a stem similar to the stem of attachment of young Medusæ, which is only much more elongated, and from which similar branches may bud.

The analogy of some genera of Hydroid Polypi, such as Coryne and Syncoryna to Medusæ, is apparently more remote, from the circumstance that the tentacles are scattered around the surface of the terminal bulb; but it requires only a close comparison of the mode of formation and increase of the tentacles in those genera in which they form a regular whorl, to satisfy the observer, that even in those Medusæ, in which the regular crown of tentacles seems to form strictly a whorl, the tentacles in their successive development do not arise from the same level, but that there are some which are inserted nearer the centre of the axis than others; so much so, that an elongation of the axis upon which they stand would produce an arrangement similar to that which we notice in Coryne and Syncoryna, where they are regularly scattered. Even in the latter genus the analogy is complete, for the uppermost end of the main bulb terminates with a regular opening, surrounded with minute fringes, though this aperture seems to have been overlooked by former observers. Though a mouth is mentioned in the characteristics of Coryne, in Syncoryna it seems to have escaped attention. I may add, that there is a remarkable correlation between the number of tentacles which exist nominally upon a terminal bulb of Syncoryna and the nominal number of radiating tubes and tentacles, which are developed in the little Sarsia produced from that Hydroid Polyp. Syncoryna has generally sixteen tentacles, four times as many as the free Medusæ to which it gives birth.

In no Hydroid Polyp is the structure of the tentacles more closely allied to that of some of the naked-eyed Medusæ than in Syncoryna, for their club-shaped tentacles with lasso cells, remind us most distinctly of the tentacles of Slabberia; and so far as these comparisons are conclusive, there remains no doubt in our mind, that from their structure and Morphology, the so-called Hydroid Polypi must be considered as true Medusæ, among which they constitute a type

analogous to the stalked Crinoid among Echinoderms; an analogy which is the more remarkable, as in their ultimate generation Hydroid Polypi produce free Medusæ, while the Comatulæ arise from the Crinoids provided with stems.

Abstract of a Communication on the recent progress of the Telegraph Operations of the U. S. Coast Survey, by Prof. A. D. Bache.

Prof. A. D. Bache, Superintendent of the U. S. Coast Survey, communicated to the Association the recent progress of the Telegraph Operations of the Coast Survey, under the immediate charge of Mr. Sears C. Walker, one of the Assistants.

A brief account of these operations to the date of August, 1849, was given at the last meeting of the Association. The work for connecting Hudson, (Ohio,) the site of Prof. Loomis' astronomical labors, with two Atlantic stations, had then just been completed, thereby rendering available for longitudes the valuable series of occultations, eclipses and moon culminations, observed by Prof. Loomis, from 1838 to 1844.

In October and November, 1849, a second series of observations was concluded for the connection of Cincinnati Observatory, under the direction of Prof. Mitchel, with the Seaton station, (one of the Coast Survey stations in the District of Columbia.)

Recently, in February, 1850, operations were undertaken for the connection of the same station (Seaton,) with the Charleston Observatory, under the direction of Professor Gibbes. These observations have not yet been fully reduced. As an approximate result, it may be mentioned that Prof. Gibbes' Observatory in Charleston is eleven minutes and forty-three seconds in time west of the meridian of the Capitol.

In the operations of January 3d, 1849, between Washington, Philadelphia, New-York, and Cambridge, (Mass.) Mr. Walker noticed a slight discrepancy in the local readings of the dates of the transits of the stars.

This difference, though small, was still too great to be overlooked in the operations. In searching for the cause of the discrepancy, two hypotheses occurred to him. One was, that it is to be ascribed chiefly to the sensible time taken for the hydro-galvanic waves to be propagated from one station to another. A second hypothesis was, that this phenomenon was to be ascribed to the difference of what

may be termed *accidental* circumstances, peculiar to the apparatus, and at the stations, and to the telegraph wires.

A careful discussion of the effect of these circumstances showed that they probably undergo a compensation in the mean of a great variety of experiments, and leave, apparently, the residual phenomenon attributable to wave time to stand out distinctly from the rest.

On this hypothesis he found, from the operations of January 23d, 1849, that the hydro-galvanic waves are propagated through about nineteen thousand miles per second, their velocity being about one tenth part of that of light, and (according to the experiments of Mr. WHEATSTONE and Mr. SAXON) of frictional electricity.

The conclusions derived from the work of January 23d, 1849, have been since confirmed, particularly by that of October 31st and November 21st, between Washington and Cincinnati. From these experiments Mr. WALKER found a velocity of the wave somewhat slower, viz: only sixteen thousand miles per second. The resistance of the batteries, or other circumstances of this line, may be found to explain this difference, which appears greater than the accidental errors.

From a report by Mr. R. CULMANN, of the Bavarian engineers, now on a visit to this country, drawn up at my invitation, it seems not improbable that the ground offers greater facility of conduction than the iron wires of the size now used in telegraph lines. The comparative resistance of the ground, the wires and the batteries, has not yet been fully discussed.

The work of February 4th, from Washington to St. Louis, via Pittsburg, through one thousand miles of wire and seven hundred miles of ground, with alternations of relative position of batteries, affords ample material for discussing the questions when the observations shall have been reduced.

The work with Charleston last month, as far as has been discussed, is confirmatory of former results in relation to the velocity of the galvanic waves, the correction for relative wave time, in the work with Charleston, being nearly the same as that which had been indicated by the work of the preceding night with St. Louis. The difference in the determinations of wave time in the different experiments seems, however, to require explanation.

Prof. MITCHELL has taken a different view of the explanation of these results from Mr. WALKER; and the whole subject would, no

doubt, undergo a searching discussion. Prof. BACHE observed that he merely stated, as reported, the present appearance of the results.

Prof. BACHE then exhibited specimens of the actual registering fillets used at Washington and St. Louis, on the 4th February last, and a transcript of a portion of those at Pittsburg, Cincinnati, Louisville and St. Louis; on all of which the same time scale was printed automatically, by means of Mr. SAXTON'S circuit breaking clock, used at the Seaton station.

The arbitrary signals consisted of one dot, or a pair of dots separated by a short line, caused by the breaking of the circuit by the operator at St. Louis. If the velocity of the hydro-galvanic waves had been as great as that of light, the cêntre of the St. Louis dots, as printed on the St. Louis and Seaton time scales, would differ only one-hundredth of a second, the Seaton station reading being in excess.

The members of the Association may see that instead of the Seaton station reading being only a hundred, it is more than ten times that quantity (viz: about one-eighth of a second) in excess.

The spaces which record the clock and signal breaks have nearly the same deviation at all the stations, showing that the effect of the *accidental* circumstances connected with the telegraph apparatus and line are nearly insensible. leaving the phenomenon due to wave time in full relief.

The work has not been entirely reduced, but it seems likely to exhibit a velocity rather below sixteen thousand miles per second.

Prof. BACHE then called the attention of the Association to an interesting fact which had been pointed out to him by Mr. WALKER, viz: that the telegraph line, when connected with a battery in action, propagates the hydro-galvanic waves in either direction, without interference.

In the telegraph wire, when connected with a battery, the waves produced by making and breaking, when made at the same time at St. Louis and Washington, cross each other without interference.

In illustration of this remark, Prof. BACHE exhibited cases where the *line* made between two pauses, (or dots,) by the St. Louis operator, at the same instant with the Seaton station clock pause, appears to *precede* the *clock* pause on the St. Louis register, and to *follow* it on the Seaton station register.

This experiment appears confirmatory of Mr. WALKER'S wave time hypothesis, and, as now understood, shows that in the same manner as several successive syllables of sound may set out in succession

from the same place, and be on their way at the same time to the listener at a distance, so also where the telegraph line is long enough, several waves, caused by making and breaking the circuit, and represented on two registers by lines and dots as pauses, may be on their way from the signal station before the first one reaches the receiving station.

Two persons at a distance may pronounce several syllables at the same time, and each hear those emitted by the other.

So, on a telegraph line of two or three thousand miles in length, in the air, and the same in the ground, two operators may, at the same instant, commence a series of several dots and lines, and each receive the other's writing, though the waves have crossed each other on the way. The relative positions of the two series being reversed at the two stations.

Prof. BACHE then remarked on the extreme difficulty of the connection of New-Orleans with Washington, in longitude, by the telegraph, at one operation, owing to unfavorable meteorological circumstances along the route.

This circumstance had induced him to make a double effort—the one to reach it by Charleston, the other by Cincinnati.

He was happy to acknowledge the liberality of the President, ELAM ALEXANDER, Esq., and the directors of the Southern line, in giving the Coast Survey free use of the line after office hours, at nights—a liberality which had also been exercised by the directors of the O'REILLY lines on the Western route.

At half past two, the Association adjourned, to meet at 6 P. M., at the South-Carolina Hall.

LEWIS R. GIBBES, *Secretary.*

Fourth Day, Friday, March 15, 1850.

EVENING SESSION.

Rev. Dr. BACHMAN was requested to take the Chair.

Lieut. MAURY read his paper,

On the General Circulation of the Atmosphere.

SEVERAL years ago, I commenced to gather from old sea journals, such information as they might be found to contain, relating to the winds and currents of the sea, and to embody the information so obtained in a series of charts, in such a manner as to show by pictures, the prevailing direction of the winds and currents for every month, and in every part of the ocean. Indeed, the plan of the undertaking was to collect the experience of every navigator, and to present the combined results of the whole in such a manner, that each one might, with a glance, have the benefit of the experience of all who had preceded him in any of the frequented parts of the ocean.

This enterprize has been seconded by the government and individuals. American ship-masters generally have come into it with great zeal. They make the observations required on every voyage, and send them to me at Washington. There are some thousands or more ships voluntarily co-operating with me in all parts of the ocean, and as it might be supposed, from such a number of active and intelligent observers, we are collecting materials of great value.

During the course of these investigations, many interesting facts are developed, amounting, in some cases, to actual discoveries of great interest—such as a new route, which shortens the sailing distance to the Equator, some fifteen or twenty per cent, and, of course, proportionately to all ports beyond. The existence in the North Atlantic of a regular Monsoon, and in the North Pacific near the West coast, of a perpetual South-West Trade Wind, near the Equator, a unique phenomenon, also, the existence, near the same place, of a system of Monsoons.

My present purpose, however, is not to speak of the discoveries, but rather to treat of the insight which these investigations, undertaken on such a large scale, affords as to the general system of atmospherical circulation over the earth.

They teach us to regard the atmosphere as a vast machine.

It is a sewer into which with every breath we cast vast quantities of dead animal matter. It is a laboratory, into which, when the light and heat enter, they act upon this dead matter, decompose it, and resolve it into gaseous substances, to be by their action again condensed into plants and trees.

If it were not for this condensation, the air would become tainted;

it would send its impurities back into the lungs; and continually receiving back more in return, it would finally become unfit for the respiration of certain animals, and man would perish from the face of the earth.

We hunger and take food that has been gathered from the vegetable kingdom, into the stomach, there it is elaborated into flesh and blood. After it has coursed through the system, and performed its office, it is again cast forth into the atmosphere, to be reconverted into more vegetables, to serve as food for other animals. Doubtless the animal and vegetable kingdoms are in exact counterpoise: the one destroying, the other re-arranging and rendering fit for use again, this same dead animal matter. In infinite wisdom, the two kingdoms are so balanced that there is not an insect to much on one side, nor a green leaf too little on the other.

These operations are carried on daily and hourly through the atmosphere which we are breathing. How important and profitable therefore, does the study of its laws become!

It is an engine which pumps our rivers up from the sea, and carries them through the clouds to their sources in the mountains. Air and water are the great agents of the sun in distributing his heat over the surface of the globe, cooling this climate and tempering that; and in this light, I propose to consider the winds and the currents.

Though the winds blow here from the four quarters, and sometimes with such violence as to fill the mind with sentiments of awe, and emotions of terror, yet such winds, in comparison with the general system of atmospheric circulation, are but eddies to the main current. They have no more effect in deranging or disturbing that system of circulation, than the shower which they bring with them has upon the Gulf Stream and other great currents of the sea.

From the parallel of about 30° north and south, nearly to the Equator, we have two zones of perpetual winds, viz: the zone of north-east trades on this side, and of south-east on that. They blow perpetually, and without a moment's interruption, the year round. They are as steady and as constant as the current of the Mississippi river—always moving in the same direction.

As these two currents of air are constantly flowing from the Poles towards the Equator, we are safe in assuming that the air which they keep in motion must return by some channel to the place near the Poles, whence it came, in order to supply the trades. If this were not so, these winds would soon exhaust the Polar regions of atmos-

phere, and pile it up about the Equator, and then cease for the want of air to make more wind of.

This return current, therefore, must be in the upper regions of atmosphere, at least until it passes over those parallels between which the trade winds are always blowing on the surface. The return current must also move in the direction opposite to the direction of that wind which it is intended to supply. The direct and counter currents are also made to move in sort of spiral or loxodromic curves, turning to the west from the Poles to the Equator, and in the opposite direction from the Equator towards the Poles.

This motion is caused by the motion of the earth on its axis.

The earth, we know, moves from west to east. Now, if we imagine a particle of atmosphere at the North Pole, where it is at rest, to be put in motion in a straight line towards the Equator, we can easily see how this particle of air, coming from the Pole, where it did not partake of the diurnal motion of the earth, would, in consequence of *vis inertia*, find, as it travels south, the earth slipping under it, as it were, and thus it would appear to be blowing from the north-east and going towards the south-west.

On the other hand, we can perceive how the particles of atmosphere that start from the Equator to take the place of the other at the Pole, would, as it travels north, and in consequence of its *vis inertia*, be going towards the east faster than the earth. It would, therefore, appear to be blowing from the south-west and going towards the north-east, and exactly in the opposite direction to the other. Writing south for north, the same takes place between the South Pole and the Equator.

Now, this is the process which is actually going on in nature, and if we take the motions of these two particles as the type of the motion of all, we shall have an illustration of the great currents in the air, the Equator being a node, and there being two systems of currents—an upper and an under—between it and each Pole.

Let us return now to our northern particle, and follow it in a round from the Pole to the Equator and back again, supposing it, for at present, merely to turn back after reaching the Equator.

Setting off from the polar regions, this particle of air, from some reason, which does not appear to have been satisfactorily explained by philosophers, travels in the upper regions of the atmosphere, until it gets between the parallels of 30° and 40°. Here it meets, also in the clouds, the particle that is going from the Equator to take its place at the Poles.

Between these two parallels, then, these two particles meet, press against each other with the whole amount of their motive power, produce a calm and an accumulation of atmosphere sufficient to balance the pressure from the two winds North and South.

From under this bank of calms, two surface winds are ejected, if you please, one towards the Equator, as the north-east trades—the other towards the Poles, as the south-west passage winds, supposing that we are now considering what takes place on this hemisphere only.

These winds come out at the lower surface of the calm region, and consequently the place of the air borne away in this manner is supplied by downward currents from the super-incumbent air of the calm region.

Like the case of a vessel of water which has two streams running in at the top, and two of equal capacity discharging in opposite directions at the bottom. The motion of the water in the vessel is downward.

The barometer, in this calm region, stands higher than it does either to the north or to the south of it; and this is another proof as to the banking up here of the atmosphere.

Following our imaginary particle of air from the north across this calm belt, we now feel it moving on the surface of the earth as the north-east trade wind, and as such it continues on till near the Equator, where it meets a like particle, which has blown as the south-east trades.

Here there is another meeting of winds, and another calm region, for a north-east and south-east wind cannot blow at the same time in the same place. The two particles have been put in motion by the same power; they meet with equal force, and, therefore, at their place of meeting, are stopped in their course. Here there is also a calm belt.

Warmed by the heat of the sun, and pressed on each side by the whole force of the north-east and south-east trades, they ascend—the reverse of the operation which took place at the other meeting near the parallel of 30°.

This imaginary particle now returns to the upper regions of the atmosphere again, and travels there until it meets its fellow particle from the north, where it descends as before, and continues on towards the Pole as a surface wind from south-west.

Entering the Polar regions obliquely, it is pressed upon by similar currents coming from every meridian, and approaching the higher parallels more and more obliquely, until our imaginary particle, with

all the rest, is whirled about the Pole in a continued circular gale, until, reaching the vortex, it is carried upwards to the regions of atmosphere above, in which it commences again its circuit to the south.

If we imagine this sheet to be a perpendicular section through the atmosphere, from the Polar to the Equatorial regions, and on it trace the track of our imaginary atom of air, it will describe a sort of true-lover's knot or figure of 8.

Thus: commencing at the north, it goes in the upper regions as an atmospherical current, until it arrives between the parallels of 30° and 40°.

Here, in the calm region, it descends and becomes a surface current in the shape of the north-east trades; arrived near the Equator, it is becalmed, ascends, and commences its return to the north as an upper current, till it reaches the calm regions of the "Horse Latitudes," where it is again becalmed. Here, though, instead of ascending, as at the Equator, it descends, and is felt as the south-west passage wind, and thus the circuit is complete.

The Bible frequently makes allusions to the laws of nature, their operation and effects. But such allusions are often so wrapped in the folds of the peculiar and graceful drapery with which its language is occasionally clothed, that the meaning, though peeping out from its thin covering all the while, yet it lies, in some sense, concealed, until the lights and revelations of science are thrown upon it—then it bursts out and strikes us with more force and beauty.

As our knowledge of nature and her laws has increased, so has our understanding of many passages in the Bible been improved.

The Bible called the Earth a "round world," yet for ages it was a most damnable heresy for Christian men to say, the world is round; and, finally, sailors circumnavigated the globe, proved the Bible to be right, and saved Christian men of science from the stake.

"Canst thou tell the sweet influences of the Pleiades?"

Astronomers of the present day, if they have not answered the question, have thrown so much light upon it as to show that, if ever it be answered by man, he must consult the science of Astronomy.

It has recently been all but proved, that the Earth and Sun, with their splendid retinue of comet, satellite and planet, are all in motion around some point or centre of attraction inconceivably remote, and that that point is in the direction of the star Alcyon, one of the Pleiades!

And as for the general system of atmospherical circulation, which

I have been so long endeavoring to describe, the Bible tells it all in a single sentence: "The wind goeth towards the south and turneth about unto the north; it whirleth about continually, and the wind returneth again according to his circuits." Ecc. i, 6.

A like operation takes place in the southern hemisphere. We now see the general course of the "wind in his circuits," as we see the general course of the water in a river. There be many abrading surfaces, irregularities, etc., which produce a thousand eddies to the main stream, yet, nevertheless, the general direction of the whole is not disturbed nor affected by those counter currents; so with the atmosphere and the variable winds which we find here. But, to return: In the lower half of the loop the wind is permanently from the north-east; in the upper half it prevails from the southward and westward. Hence, the passage of sailing vessels is so much shorter from New-York to England than from England back this way—the difference is as 2 to 3.

We see, also, that there must be about the earth three zones, in which calms are the prevalent condition of the air. One of these zones is near the Equator, where the north-east and south-east trade winds meet and form what is called the Equatorial calms.

The other zones lie between those parallels where the "wind that goeth towards the south" meets that which "turneth about unto the north."

These zones are several degrees of latitude in breadth, and that in the North Atlantic is known as the "Horse Latitudes," from the circumstance that vessels bound with loads of horses from New-England to the West Indies were generally unfortunate here. This trade in horses was very great, and, in the time of stage coaches. consisted of old horses, which, having been broken down here, were taken up, fattened and shipped off to the West Indies.

In crossing this zone, it often happened that the calms were so uninterrupted that the vessel would be detained there many days, during which the horses would drink up all the water, become frantic with thirst, and the whole, or a part, would then have to be thrown overboard. Hence, the name of "Horse Latitudes" for this zone, There is a duplicate to this zone in the southern hemisphere. These three zones encircle the Earth.

About each pole we have, or, according to the views I have been endeavoring to make plain, we ought to have, a perpetual whirlwind.

The wind approaches the North Pole by a series of spirals from the south-west. If we draw a circle about the Pole, we shall see that the wind enters all parts of this circle from the south-west, consequently the whirlwind is created thereby, which revolves from right to left, or against the hands of a watch.

At the South Pole the winds come from the north-west, and consequently here they revolve about it with the hands of a watch.

It is a singular coincidence between these two facts thus established, and other facts which have been observed, and which have been set forth by REDFIELD, REID, PIDDINGTON and others, viz: that all rotary storms in the northern hemisphere revolve as do the whirlwinds about the North Pole, viz: from right to left, and that all circular gales in the southern hemisphere revolve in the opposite direction, as does the whirl about the South Pole.

How can there be any connection between the rotary motion of the wind about the Pole and the rotary motion of it in a gale caused here by local agents?

So far, we see how the atmosphere moves; but the atmosphere, like every other department in the economy of nature, has its offices to perform; and they are many. I have already alluded to some of them. But I only propose in this paper to consider some of the meteorological agencies which, in the grand design of creation, have been assigned to this wonderful machine.

To distribute moisture over the surface of the earth, and to temper the climate of different latitudes, are two of the great offices assigned by their Creator to the ocean and the air.

When the north-east and the south-east trades meet and produce the Equatorial calms of the Atlantic, the air by this time is heavily laden with moisture—for, in each hemisphere it has travelled obliquely over a large space of ocean. The two winds meet here with opposing forces so nicely balanced that they neutralize each other, and a calm is the consequence; and, as one is pressing from the north and the other from the south, upon the atmosphere over this calm region, each with the whole amount of force that sets it in motion, we ought to have in this calm region an accumulation of atmosphere equal to the sum of those forces. Now, if we had barometrical determinations accurately made in the region of these calms, we should probably obtain an expression, in horse power, if you please, of the whole amount of force exerted by the sun in keeping up this system of atmospherical circulation—for it is the heat of the sun which causes

the winds to blow and the waters to flow; at least, it is the chief source of their motive power.

The air of the Equatorial calms being charged with moisture, is thus compressed, and has no room for escape, but in the upward direction. In this direction it reaches a cooler region; a portion of its vapor is condensed, and comes down in the shape of rain. Therefore it is, that under these calms we have a region of constant precipitation.

Old sailors tell us of such dead calms of long continuance here, of such heavy and constant rains, that they have scooped up fresh water from the surface of the sea.

The conditions to which this air is exposed here under the Equator are probably not such as to cause it to precipitate all the moisture that it has taken up in its long sweep across the waters.

Let us see what becomes of the rest—for nature, in her economy, permits nothing to be taken away from this earth which is not to be restored to it again in some form, and at some time or other.

Consider the great rivers—the Amazon and the Mississippi for example—we see them day after day, and year after year, discharging an immense volume of water into the ocean.

"All the rivers run into the sea, yet the sea is not full." Ecc. i, 7.

Where do the waters so discharged go, and where do they come from?

They come from their sources you will say. But whence are their sources supplied?—for, unless what the fountain sends forth be returned to it again, it will fail and be dry.

We see simply, in the waters that are discharged by these rivers, the amount by which the precipitation exceeds the evaporation throughout the whole extent of valley drained by them—and by precipitation I mean the total amount of water that falls or is deposited, whether as dew, rain, hail or snow.

The springs of these rivers are supplied from the rains of heaven, and these rains are formed of vapours which are taken up from the sea, that "it be not full," and carried up to the mountains through the air.

"Note the place whence the rivers come, hither they return again," is a dictum of the wise man.

Behold now the waters of the Amazon, of the Mississippi, the St. Lawrence, and all the great rivers of America, Europe and Asia, lifted up by the atmosphere, and flowing in invisible streams through

the air back to their sources, and that through channels so regular, certain, and well defined, that the quantity taken up one year with the other is nearly the same, for that is the quantity which we see running down to the ocean through these rivers, and the quantity discharged annually by each is, as far as we can judge, as constant.

We now begin to see what a powerful machine is the atmosphere, and though it is apparently so capricious and wayward in its movements, here is evidence of order and arrangement which we must admit, and proof which we cannot deny, that it performs this mighty office with regularity and certainty, and is therefore as obedient to law as the steam engine to the will of its builder.

It too is an engine. The South Seas themselves in all their vast extent are the boiler for it, and the northern hemisphere is its condenser.

The proportion between the land and the water in the northern hemisphere is very different from the proportion between them in the southern. In the northern hemisphere, the land and water are nearly equally divided. In the southern, there is about ten times more water than land. All the great rivers of the world are in the northern hemisphere, where there is less ocean to supply them. Whence then are their sources replenished? Those of the Amazon are supplied with rains from the Equatorial calms. That river runs E., its branches come from the north and south; it is always the rainy season on one side or the other of it, consequently it is a river without periodic stages. It is always at high water mark. For one half of the year its northern tributaries are flooded, and its southern for the other half. It discharges under the line, and as its tributaries come from both hemispheres, it cannot be said to belong exclusively to either. It is supplied with water from the Atlantic Ocean.

Taking the Amazon therefore out of the count, the Rio de la Plata is the only great river of the southern hemisphere.

There is no large river in New Holland. The South Sea Islands give rise to none, nor is there one worth naming in South Africa.

The great rivers of North America and North Africa, and all the rivers of Europe and Asia, lie wholly within the northern hemisphere. How is it then, considering that the evaporating surface lies mainly in the southern hemisphere, how is it, I say, that we should have the evaporation to take place in one hemisphere and the condensation in the other? The total amount of rain which falls in the northern hemisphere is much greater than that which falls in the

southern. The annual amount of rain in the North Temperate Zone is half as much again as that of the South Temperate.

How is it then that this vapour gets from the southern into the northern hemispheres, and comes with such regularity that our rivers never go dry and our springs fail not? It is because of the beautiful operations of this grand machine—the atmosphere. It is exquisitely and wonderfully counterpoised. Late in the fall, throughout the winter, and in early spring, the Sun is pouring his rays with greatest intensity down upon the seas of the southern hemisphere, and this powerful engine which we are contemplating is pumping up the water there for our rivers with the greatest activity. At this time, the mean temperature of the entire southern hemisphere is about 10° higher than the northern.

The heat which this heavy evaporation absorbs becomes latent, and with the moisture is carried through the upper regions of the atmosphere, until it reaches our climates. Here the vapour is formed into clouds, condensed and precipitated. The heat which held this water in the state of vapour is set free, it becomes sensible heat, and it is that which contributes so much to temper our winter climate. It clouds up in winter, turns warm, and we say we are going to have falling weather. That is because the process of condensation has already commenced, though no rain or snow may have fallen, and we feel this southern heat that has been set free in the process.

While evaporation is going on with most activity in the southern hemisphere, precipitation is taking place to the greatest extent here; the fall spell, the winter rains, and the "long season in May," are familiar times of wet weather to us all. These are the seasons at which we look for high water, and expect our "inland seas" to be in good navigable order.

The vapour comes through the upper regions of the atmosphere, and is probably condensed here not many days after it is taken up there. Suppose it to travel with the velocity of the trade winds, at the rate of twenty miles the hour, it will only take it about twenty days to reach us from the middle of the southern hemisphere.

We cannot ascend into the upper regions of the atmosphere to see what is going on there; but we have such a train of well established facts derived from observation here below, that reason mounting on them, boldly soars aloft, and confidently asserts knowledge of what is going on there.

When we see and feel, as in the trade wind region we do day after day the year round, the wind blowing as steadily from the Poles towards the Equator, as the Mississippi runs down to the Gulf, we are forced to the conclusion that as much air, precisely as much as we see here coming from towards the Poles, and going towards the Equator, has to go from the Equator back towards the Poles. If this were not so, there would be an exhaustion, and this wonderful engine that we are considering would break down, for there would finally be a vacuum about the Poles with a tremendous atmospherical accumulation about the Equator.

Recurring to the figure of 8 illustration, and considering both hemispheres, we shall see that the atmosphere, like the string of a musical instrument, has its nodes or points of rest. These nodes serve as escape valves to the winds. In the Equatorial calms, both the N. E. and S. E. trades have run their course on the surface, they are going up to blow as upper currents, and therefore the motion of the air here in these calms, could it be seen and measured, would be upwards; and for the same reason, when the two upper currents meet in the region of Horse Latitudes, the motion of the air is downward, for after passing this node, each upper current becomes a surface wind, and each is going whence the other came.*

Important operations are carried on, and purposes grand in the system of terrestrial economy are subserved by these atmospheric nodes.

This singular fact has been brought out by the investigations which we are conducting at the Observatory with regard to the winds. Our investigations in the Atlantic, for we have not carried them much further, show us that the S. E. trade wind region is much larger than the N. E.—I speak of its extent over the Atlantic Ocean only.

The S. E. trades often push themselves up to 10° or 15° of north latitude, whereas the N. E. trade winds seldom get south of the Equator.

Seeing that there is so much more room for evaporation in the southern than in the northern hemisphere, and that there is so much more precipitation on this than on the other side of the Equator, we

* If this interchange of atmosphere did not take place between the two hemispheres, how would a proper mixture of the air be preserved. In the North there is much more land, and many more plants and animals to corrupt it than in the South, and unless the interchange did take place, there would be reason to infer a difference as to atmospherical purity in the two hemispheres.

are led to one of two conjectures; first, that aqueous vapour in its invisible state can permeate the atmosphere; in other words, it can flow through the air in separate or independent currents of its own, like some of the gases. In this case, we must further conjecture the seat of some power unknown, which would always drive this vapour from the southern over into the northern hemisphere. We know of no such force in nature, and in this age men would scarcely receive such a conjecture.

Abandoning this therefore, we are next led to the second conjecture, which is, that the motion of the air in the general system of circulation is not such as represented in the figure already described; but that the N. E. trade winds for instance, when they reach the Equatorial calms, instead of turning back towards the north, as is there supposed, keep on towards the south, and the S. E. trade winds make the tour north. In this case, the course of them, as described by SOLOMON, would be thus:

If this be a true representation of the course of the winds, we shall see that the S. E. trade winds would enter the northern hemisphere, and bear into it all their moisture, except that which is compressed in the region of Equatorial calms.

That the Zone over which the S. E. trade winds blow is of an area greater than that over which the N. E. trade winds blow, does not go to show by any means that the body of air flowing from the South Pole to the Equator, is greater than that which comes from the North Pole to meet it.

All that is necessary to establish a perfect equilibrium between the two winds—and no doubt they are in nature truly counterpoised—is to suppose that they extend to the same height, and blow with equal velocity. In this case, we can readily perceive how the whole amount of air which the N. E. trades daily bear across the parallel of 10° N. for instance, is equal to the whole amount which the South East trades bear across the parallel of 10° S. in the same time.

I have no observations bearing directly upon this point; but we know by whom this mighty atmospherical engine was built, and that his works are never out of order; they are always in the proper proportions and in exact counterpoise.

The South Sea then supplies mainly the water for this engine, while the northern hemisphere condenses it; we should therefore have more rain in the northern hemisphere—the rivers tell us that on our side of the Equator, the great water courses of the globe and half the fresh water in the world, is found in our northern and this alone.

The rain gauge tells us also the same story. The yearly average of rain in the North Temperate Zone is, according to Johnson, 37 inches. He gives but 26 in the South Temperate.

Moisture is never extracted from the air by subjecting it from a low to a higher temperature, but the reverse. Thus all that air which comes loaded with moisture from the other hemisphere, and is borne into this by the S. E. trade winds, travels in the upper regions of the atmosphere until it reaches the horse latitudes—here it becomes the surface wind that travels to the northward and eastward. As it goes north it grows cooler, and the process of condensation commences.*

* The peculiar clouds of the trade winds are formed between the two currents of air. They are formed of vapour condensed from the upper current, and evapo-

We may now liken it to the wet sponge, and the decrease of temperature to the hand that squeezes that sponge. Finally, all the moisture that a dew point of zero, and even far below, can extract, is parted with, and this air then commences "to return according to his circuits" as dry atmosphere; it does not come in contact with the surface of the water, but remains isolated in the upper regions from all sources of vapour, until it crosses the "Horse Latitudes," and commences to blow the trades. Here, it is as the dry sponge, taking up and evaporating fresh water from the sea with great avidity. By the time these winds reach the Equatorial calms, they are saturated with moisture; thus loaded, they return to refresh the earth with rain, to cover the hills with snow, and to supply the fountains of our great rivers with water.

By reasoning in this manner, we are led to the conclusion that our rivers are supplied with their waters principally from the trade wind regions—the northern rivers from the southern trades, and the southern rivers from the northern trade winds.

If this be so, then thė saltest portion of the sea should be in the trade wind regions, where the water for all the rivers is evaporated—and there the saltest portions are found.

Dr. Ruschenberger, of the Navy, on his late voyage to India, was kind enough to conduct a series of observations on the specific gravity of sea water.

In about the parallel of 17° N. and S.—the middie of the trade wind regions—he found the heaviest water. Though so warm, the water here was heavier than the cold water to the south of the Cape of Good Hope.

In summing up the evidence in favor of this view of the general system of atmospherical circulation, it remains to be shown how it is, if the view be correct, there should be smaller rivers, or less rain in the southern hemisphere.

The N. E. trade winds returning from the polar regions where the moisture has been compressed out of them, remain, as we have seen, dry winds until they cross the Zone of "Horse Latitudes," and are felt on the surface as the N. E. trades. About two-thirds of them only can there blow over the ocean, the rest blow over the land,

rated as it descends, by the lower and dry current forms from the Poles. It is the same phenomenon up there which is so often observed hero below; when a cool and dry current of air, meets a warm and wet one, an evolution of vapour or fog ensues.

over Asia, Africa and North America, where there is but compara tively a small portion of evaporating surface exposed to them.

The Zone of these trades extends from about 25° North to the Equator. Now if we examine the globe to see how much of this Zone is land and how much water, we shall find, commencing with China and coming over Asia, the broad part of Africa, and so on across this Continent to the Pacific, land enough to fill up as nearly, or it may be, just one-third of it, equal to 120° of longitude.

Two-thirds then only of the N. E. trade winds are fully charged with moisture, and only two-thirds of the rain of the northern hemisphere falls in the southern.

This point of view is one which is not capable of any more than the rudest approximations, for the greater extent of S. E. trades on one side, and of high mountains on the other, must each of necessity have its effect.

These calm and trade wind regions or belts, move up and down the earth in latitude nearly a thousand miles. In July and August, the Zone of Equatorial calms is found between 7° N. and 12° N., in March and April, between lats. 5° S. and 2° N.

With this fact and the chart of the N. E. trades before us, it is easy to perceive why it is that we have a rainy season in Oregon, a rainy and a dry season in California, another at Panama, two at Bogota, none in Peru, and one in Chili.

In Oregon, it rains every month, but more in the winter months.

The winter there is the summer of the southern hemisphere, when this steam engine is working with the greatest pressure. The vapour that is taken up by the S. E. trades, is borne along over the region of N. E. trades to lat. 35° or 40°, where it descends and appears on the surface with the S. W. winds of those latitudes. Driving upon the highlands of the Continent, this vapour is condensed and precipitated during this part of the year almost in constant showers.

In the winter, the belt of the "Horse Latitudes" in this hemisphere approaches the Equator. This whole system of Zones, viz.: trades, calms and westerly winds, follows the Sun.

The S. W. winds crowding down at this season to the south, reach as far down as the lower part of California; and the same cause which made it rain in Oregon, now makes it rain in California. As the Sun returns to the North, he brings the belt of "Horse Latitudes" and N. E. trades along with him; and now at places where six months before, the S. W. winds were the prevailing winds, the

the Atlantic until they reach the Coast of Brazil. By this time they are heavily laden with vapour, which they continue to bear along across the Continent, depositing it as they go, and supplying the sources of the Rio de la Plata and Southern tributaries of the Amazon.

Finally, they reach the snow-capped Andes, and here is wrung out of them the last particle of moisture that that very low temperature can extract.

Reaching the summit, they now tumble down as cool and dry winds in the slopes beyond. Meeting with no evaporating surface, and with no temperature *colder* than that to which they were subjected on the mountain top, they reach the ocean before they become charged with fresh vapor, and before, therefore, they have any which the Peruvian climate can extract. Thus we see how the top of the Andes becomes the reservoir from which are supplied all the rivers of Chili and Peru.

We see, moreover, that the Andes and all other mountains which lie North and South have a dry and a rainy side, and that the prevailing winds of the latitude determine which is the rainy and which the dry side.

Thus the southern coast of Chili: In our summer time, when the Sun comes North, and drags after him his belts of perpetual winds and calms, that part of the coast is left within the regions of the N. W. winds—the winds that are counter to the S. E. trades—which, cooled by the winter temperature of the highlands of Chili, deposite their moisture copiously. During the rest of the year the most of Chili is in the region of the S. E. trades, and the same causes which operate in California to prevent rain there, operate in Chili: only the dry season in one place is the rainy season of the other.

Hence we see that the weather side of all such mountains as the Andes is the wet side, and the lee side the dry.

We shall now be enabled to determine, if the views which I have been endeavoring to present be correct, what parts of the earth are subject to the greatest fall of rain. They should be on the slopes of those mountains which the trade winds first strike after having blown across the greatest tract of ocean.

If, therefore, we commence at the parallel of about 30° N. in the Pacific, where the N. E. winds first strike that ocean, and trace them through their circuits till they first strike high mountains, we ought to find such a place of heavy rains.

Commencing at this parallel in the North Pacific, the N. E. trades blow thence and reach the region of Equatorial calms, near the Caroline Islands. Here they rise up; but, instead of pursuing the same course in the upper stratum of winds, they, in consequence of the rotation of the earth, are made to take a S. E. course. They keep in this upper stratum until they reach the "Horse Latitudes" of the South, between the parallels of 30° and 40°; after which, they become the N. W. winds of the southern hemisphere, which correspond to the S. W. of the northern. Continuing on to the S. E., they now are the surface winds, and after blowing as such over a considerable tract of ocean, they become as the wet sponge, and are abruptly intercepted by the Andes of Patagonia, whose cold summit compresses them, and with its low dew-point squeezes the water out of them. Capt. KING found the astonishing fall of water here of nearly 13 feet (151 inches) in 41 days.

We ought to expect a corresponding rainy region to be found to the north of Oregon; but there the mountains are not so high, the obstruction to the S. W. winds is not so abrupt, the highlands are farther from the coast, and the air which these winds carry in their circulation to that part of the coast, though it be as heavily charged with moisture as at Patagonia, has a greater extent of country over which to deposite its rain, and consequently the fall to the square inch will not be as great.

In like manner we should be enabled to say in what part of the world the most equable climates are to be found. They are to be found near the Equatorial calms, where the N. E. and S. E. trades meet fresh from the ocean.

Such a place cannot be found in the Equatorial regions of Eastern Africa, because there is but a small evaporating surface for the N. E. trades in the Indian Ocean. Moreover, the course of these winds is interrupted there by other and local causes, which convert them into monsoons.

It cannot be found in Western Africa, because the trade winds approach that part of the continent from the land, and not from the water, and in unequally heated currents, But it is to be found in the valley of the Amazon, where those winds meet after having traversed the Tropics all the way across the Atlantic. By such long contact with an equally heated ocean, the air becomes of a uniform temperature.

The temperature here is so equal that it is considered to be an

extraordinary and remarkable change in the weather when the mean temperature of any day varies as much as 3° from the mean of the whole year.

Here, too, is where takes place the great condensation of the water which has been taken up from the Atlantic by the two systems of trade winds.

I have never seen the records of a rain gauge kept in the valley of the Amazon; but this river itself is gauge enough to show that the fall of rain there is immense. A rain gauge kept on the verge of it gives the annual fall at 23 feet. In Washington it is about 3—in Charleston 4.

The mean annual fall of rain on the entire surface of the earth is estimated at about 5 feet.

To evaporate water enough from the ocean to cover the earth 5 feet deep with rain; to transport it from one zone to another; and to precipitate it in the right places, at suitable times, and in the proportions due, is the office of the grand atmospherical machine. This water is evaporated principally from the Torrid Zone. Supposing it all to come thence, we shall have, encircling the earth, a belt of ocean 3000 miles in breadth, from which this atmosphere evaporates a layer of water annually 16 feet in depth. And to hoist up as high as the clouds, and lower down again, all the water in a lake 16 feet deep, and 3000 miles broad and 24,000 long, is the yearly business of this invisible machinery. What a powerful engine is the atmosphere!

We see that light is beginning to break upon us—for we now begin to perceive why it is that the proportions between the land and water were made as we find them in nature. If there had been more water and less land, we should have had more rain, and *vice versa*, and then climates would have been different from what they now are, and the inhabitants, neither animal nor vegetable, would have been as they are. And as they are, that wise Being, who, in his kind Providence, so watches over and regards the things of this world that he takes knowledge of the sparrow's fall, and numbers the very hairs of our head, doubtless designed them to be.

In some parts of the Earth the precipitation is greater than the evaporation; thus, the amount of water borne down by every river that runs into the sea may be considered as the excess of the precipitation over the evaporation that takes place in the valley drained by that river.

In other parts of the Earth the evaporation and precipitation are exactly equal, as in those inland basins such as that in which the city of Mexico, the Caspian Sea, etc. etc., are situated; which basins have no ocean drainage.

If more rain fell in the valley of the Caspian than is evaporated from it, that sea would finally get full and overflow the whole of that great basin. If less fell than is evaporated, then that sea would dry up, and plants and animals would all perish there for the want of water.

In the sheets of water which we find distributed over that and every other inhabitable inland basin, we see reservoirs or evaporating surfaces just sufficient for the supply of that degree of moisture which is best adapted to the well-being of the plants and animals that people such basins.

In other parts of the earth still we find places, as the Desert of Sahara, in which neither evaporation nor precipitation takes place, and in which we find neither plant nor animal.

In contemplating the system of terrestrial adaptations, I have come to regard the great deserts of the earth, as the Astronomer does the counterpoises to his instrument—though they be mere dead weights, they are, nevertheless, necessary to make the balance complete, the adjustments perfect. They give ease to the motions, stability to the performance, and accuracy to the work of his telescope.

Wherever I turn to contemplate the works of nature, I am struck with the admirable system of counterpoises, with the beauty and nicety with which every department is poised by the others; things and principles are meted out in directions the most opposite, but in proportions so exactly balanced and nicely adjusted, that results the most harmonious are produced.

It is by the action of opposite and compensating forces that the earth is kept in its orbit, and the stars are held suspended in the azure vault of heaven, and these forces are so exquisitely adjusted, that at the end of a thousand years, the earth, the sun and moon, and every star is found to return to its proper place at the proper moment.

Nay, Philosophers tell us, when the little snow drop, which in our garden walks we may now see, raising its beautiful head to remind us that spring is at hand, was created, that the whole mass of the earth from pole to pole, and from circumference to centre, was taken into account and weighed, that the proper degree of strength might be given even to this little plant.

Botanists tell us that the constitution of this plant is such as to require that at a certain stage of its growth, the stalk should bend and the flower should bow its head, that an operation should take place, which is necessary, in order that the herb should produce seed after its kind, and that after this its vegetable health requires that it should lift its head again and stand erect. Now if the mass of the earth had been greater or less, the force of gravity would have been different; the strength of fibre in the snow drop would have been too much or too little; the plant could not bow or raise its head at the right time; fecundation could not take place, and its family would have become extinct with the first individual, because it could not have reproduced itself.

Now if we see such perfect adaptation in the case of one of the smallest flowers of the field, how much more may we not expect it in the atmosphere, upon the right adjustment of which depends not only the life of that plant, but the well being of every individual that is found in the entire vegetable and animal kingdoms of the world.

When the East blinds blow for a little while, they bring us air saturated with moisture from the Gulf Stream, and we complain of the sultry, oppressive, heavy atmosphere, the invalid grows worse, and the well man feels ill, because when he takes this atmosphere into his lungs, it is already so charged with moisture, that it cannot take up and carry off that which encumbers his lungs, and which nature has caused to be deposited there, that this atmosphere may take up and carry off. At other times the air is dry, he feels that it is conveying off matter from the lungs too fast, he realizes the idea that it is consuming him, and he calls it parching.

Therefore, in considering the general laws of atmospherical circulation, in order to get at the clue to them, I have felt myself constrained to set out with the belief, that if the atmosphere had had a greater or less capacity for moisture, or if the proportion of land and water had been different—if the earth, air and water, had not been in exact counterpoise—the whole arrangement of the Animal and Vegetable Kingdoms would have varied from its present state. But God chose to make them what they are; for this purpose it was necessary to establish the proportions between the land and water and the desert just as they are, and to make the capacity of the air to circulate heat and moisture just what it is, and to have it to do all its work in obedience to law, and in subservience to order.

Else why are we told that "He measured the waters in the hollow of his hand, and comprehended the dust in a measure, and weighed the mountains in scales and the hills in the balance?" Why but that, when he spanned the heavens, he might mete out the atmosphere in exact proportions to all the rest, and impart to it those properties and powers which it was necessary for it to have, in order that it might properly perform all those offices and duties for which he designed it? I have not the time, and if I had the time, I have not the heart so to abuse the patience of those around me, as I should do, by attemtping to take up the currents of the ocean, and to tell of the discoveries to which our system of investigation has led us with regard to those great agents in the terrestrial economy.

Harmonious in their action, they are obedient to law, and subject to order in all their movements; when we consult them in their courses, they teach us lessons—the investigations into that broad spreading circle of phenomena connected with the winds and the waves of the sea, are second to none for the good which they do and the profit which they give.

The Astronomer sees the hand of God in the sky, but the right minded Mariner who looks aloft as he ponders these things, hears His voice in every wave of the sea, and feels His presence in every breeze that blows.

PROF. A. D. BACHE, Superintendent of the Coast Survey, then gave a popular account of the Measurement of the Base Line on Edisto Island, of the apparatus used, of the difficulties attending such operations, and the means employed in overcoming the difficulties experienced.

[The article of Prof. C. U. SHEPARD is inserted here, as the proof was not received in time to insert the article in its proper place.]

Account of three new American Meteorites, with observations upon the geographical distribution of such bodies generally; by CHARLES UPHAM SHEPARD.

1. *Meteoric Stone of Richland, South-Carolina.*

THIS stone was put into my hands a year ago, by Dr. ROBERT W. GIBBES, of Columbia, to whom it had been presented by MRS. ENGLISH,

on whose estate (situated 20 miles east of Columbia,) it had been seen to fall during a violent thunder storm in the summer of 1846. The negro who witnessed its descent, ran immediately to the spot; and after digging to the depth of eighteen inches, picked it up and brought it to his mistress, with the remarkable expression, that it was a "lump of solid thunder."

It differs from all meteoric stones hitherto observed, in figure as well as composition. It is nearly round, and almost perfectly smooth, having only very slight elevations and depressions over its surface. Its diameter is two and a-half inches, and its weight six and a-half ounces.

On being slit through the centre by the lapidary, it is observed to present an uniform yellowish white color, much resembling that of the common fire-brick. A few minute grains of transparent quartz are visible throughout its substance, which is otherwise perfectly homogeneous. It is close grained and rather firm in texture. The crust is light reddish brown, and shining, without, but darker within; and is thicker than in most meteoric stones. The thickness, however, is uniform, and it is firmly adherent to the mass. In small fragments, it is attractable by the magnet.

Sp. Gr. =2.32.

Before the mouth-blowpipe, it is infusible: but by means of the oxy-hydrogen instrument, it melts into a dark blackish green glass, more vitreous and less brown than the crust.

When reduced to powder, it presented a peculiar light pearl-gray color. Decomposed by fusion with carbonate of soda, it afforded

Silica, ...	80.420
Alumina, ...	15.680
Protox. Iron, ...	2.513
Magnesia, ...	0.700
Lime, ...	0.500
	99.813

From which it is apparent that this stone, though coming within my trachytic order, stands at a wide remove from any meteoric substance heretofore described. No examination was made with a view to detect soda or potassa, both of which are probably present in minute traces.

It is probable that the compound of which this stone is principally composed, constitutes a mineral species hitherto unknown.

2. *Meteoric Stone of Cabarras Co., North-Carolina.*

This stone fell at quarter past three p. m., on the 31st of October, 1849. The place of fall was upon the estate of Mr. H. Bost, which is situated in the southwest corner of the county, eighteen or twenty miles from Concord, its shiretown, twenty-two miles east from Charlotte, and fifteen miles from Monroe, the county seat of Union. An account of the principal circumstances attending the fall of the mass has been given by Dr. J. H. Gibbon, of the United States Branch Mint, at Charlotte, which appeared in a late number of the American Journal of Science. Additional particulars of the same phenomenon have been afforded by the same gentleman, which were published in the National Intelligencer (No. 11.532). As abstracts from both these sources have been made by several papers in different sections of the country, it will be unnecessary to take up time here with further particulars on this part of the subject.* A few additional facts communicated to me by Dr. William D. Kersh, of this State, and by Dr. E. H. Andrews, of Charlotte, may be communicated on a future occasion.

For an opportunity of describing this stone, I am indebted to the kind offices of Drs. Gibbon and Andrews, of Charlotte, both of whom repaired immediately to the place of fall, and secured for me the refusal of the mass. It was soon afterwards purchased by Dr. Andrews and transmitted to me here, thus affording me the pleasure of exhibiting it to the Association almost precisely in the condition in which it was found.

The present weight is 18½ pounds,—it having been reduced one pound by the abstraction of two or three fragments by those who saw it prior to the visit of Drs. Gibbon and Andrews.

Its general figure may be judged of by the annexed drawing.

* One circumstance, however, may here be noticed in Dr. Gibbons narrative of the various descriptions of the report made by the explosion of the meteor. It is the comparison of an old hunter who was abroad engaged in fishing. He remarked that "it was like the reports of three pieces of heavy artillery, followed by the rumbling of the base-drum." Now this account resembles that given of a stone which fell Dec. 25, 1846, in the environs of Mindenthal, (near Munich) Germany, when after twenty reports similar to that produced by a distant cannonade, the noise changed to a rumbling, like that of a kettle-drum. A single stone was seen to fall and bury itself to a small depth in the soil of a garden. In size, weight and shape, the fallen mass strikingly resembled that now under consideration.

The shape reminds one the most forcibly of a human foot inclosed in an india-rubber overshoe. It nevertheless exhibits several tolerably distinct planes, giving rise to a low, irregular, four-sided pyramid, truncated at the summit, and having for a base, a somewhat rounded, undulating surface. (The angle marked A presents the fractured surface.) Its greatest length is 10½ inches, its height 5¼, and its breadth 6¾ inches. The sides present the indentations, and the angles the blunt terminations, which are so common in these bodies.

The crust is thin, black and strongly coherent, having a smooth surface, with exception of minute projections occasioned by metallic grains. In point of lustre it is quite dull. Minute portions of yellowish clay and fibres of lignin (the former from the soil into which it fell and the latter from the tree against which it struck) are still visible upon portions of the surface.

An attempt to break the mass for obtaining a fresh view of the interior, revealed a remarkable difference between this and most meteoric stones. It required repeated strong blows with a heavy hammer, to detach a fragment of one pound weight; and the fracture was at last effected only where a fissure had before been observed, and where a sort of natural joint, with perfectly glazed, plumbaginous surfaces had existed. In force of cohesion, it fully equals most trappean rocks.

Its ground color is of a dark bluish gray, stained with fine rust points. It is mottled with rounded grains and crystals of a lighter colored mineral, rendering the mass, when closely viewed, sub-porphyritic. Though rich in nickeliferous iron and pyrites, these ingredients can scarcely be discovered upon a fractured surface, owing to the fineness with which they are interspersed.

It is the first example belonging to the trappean order of stones, which has been described in the United States, and approximates most closely to the rare stone of Tabor, in Bohemia, which fell July 3, 1753.

It is strongly magnetic. Its sp. gr. varies from 3.60 to 3.66.

Tho composition of the stone, as a whole, was found to be

Nickeliferous iron (with traces of chromium),	6.320
Magnetic Pyrites,	3.807
Silica,	56.168
Protoxide of iron,	18.108
Magnesia,	10.406
Alumina,	1.797
	96.606
Traces of lime, soda and potassa, with loss,	3.394
	100.000

The earthy portion of the meteor is made up of two (possibly three) distinct minerals. One of these is olivinoid, to the amount of one-third or one-half the entire mass. It is in rounded or sub-angular grains, like one variety of leucite in certain lavas. Its color is grayish white, with a tinge of lavender blue. The size of the concretions vary from that of a mustard seed to that of a pepper corn. The other mineral is dark bluish gray. It is fine granular, approaching compact; and constitutes the paste or cement which holds the alumina and metallic ingredients together. It is impossible to separate it for investigation, by itself, and to determine whether it is a described mineral, or new. It seems more probable that it is the latter, and that it belongs to the feldspar genus. It certainly differs from howardite and from anorthite by very marked properties.

An additional interest attaches to the stone, inasmuch as its fall was succeeded by other meteoric displays, in the same region, of a very striking character. A very brilliant meteor was seen at Tampa, Florida, by Lieut. Meade of the Topographical Engineers, at 8 o'clock in the evening of Oct. 31st; while Col. A. G. Summer, of Lexington, South-Carolina, communicated the following account to the Weekly South-Carolinian, published at Columbia, Nov. 15, 1849. "On Thursday, the 1st of November, 1849, early in the morning explosions resembling distant artillery, were heard by various persons, which were mistaken for blasting explosions. These continued until the afternoon, when these fire-winged messengers of the stars became visible to the naked

eye. One exploded about two miles northeast from my residence with a stunning noise which shook the surrounding hills, and in its downward transit, emitted a clear phosphorescent light, leaving a distinct line illuminated in its course. Another, five miles northward, was observed winging its course in the same direction, at quite a leisure rate, horizontally with the earth, and being spent, exploded with noise and smoke. It appeared to be a revolving ball of white flame. At 4 o'clock, p. m., I was walking in a field at Pomaria, when a startling explosion took place, apparently three hundred yards only, distant from me. The sound was fuller than the loudest report of artillery would be at that distance, and sensibly shook the earth. Similar instances were observed in the upper part of Newberry district, thirty miles north of this place, and throughout our whole section, they were visible to many of the most respectable citizens. I have not had leisure to examine any of the locations where the explosions took place, to determine whether there have been specific mineral deposites. At night, there was a beautiful display of those "fiery tears from the skies," commonly denominated shooting stars.

"The sky was perfectly clear during the entire day, and a brilliant blue was observable, even to the horizon. The sunset was most brilliant crimson, and about 10 o'clock, P. M., the flash of the northern lights was plainly visible. The weather since has been warm to an intolerable degree, and we are now in the midst of a most charming Indian summer."

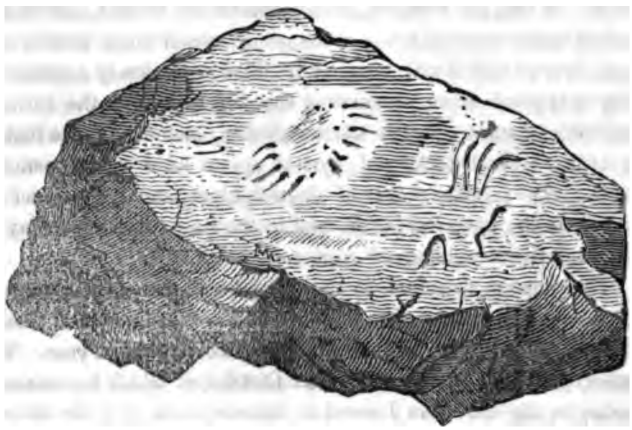
If we adopt the views of Humboldt, concerning the origin of these bodies, the phenomena under consideration would seem to present us with a stream of falling stars and aereolites, differing in its period of apparition by about twelve days from that of the first November stream, whose time has been put down by Humboldt from the 12th to the 14th of November—the time of the nearest previous asteroid ring being August the 10th.

3. *Meteoric Iron of Ruff's Mountain, Newberry, South-Carolina.*

We owe the discovery of the present highly interesting iron-mass, to Dr. Thomas Wells, (formerly of Columbia, S. C., but now a resident of New-Haven, Conn.) From several communications, with which I have been favored from this gentleman, I learn that he has but recently come into possession of the mass, and that he is still unacquainted with the particulars of its discovery. It would appear, however, that it had

been, until very recently, lying in a neglected state, near the house of a farmer, in the vicinity of the spot where it was first found.

I am indebted to Dr. WELLS for a drawing of the mass, a representation of which is here subjoined:



The figure is irregular and ovoidal, being truncate at both extremities. Its greatest length is 31 1-2 inches, while its breadth is 29 3-4 inches. It weighed 117 pounds. Judging from the specimen I have seen, it would appear that the mass was coated with a black crust, thicker than is usual in these bodies; and accordingly the specific gravity varies somewhat, as the fragments by which it was determined comprehended more or less of the coating. Two of these gave 5.97 and 6.80, while portions seemingly free from the oxidated crust gave 7,01 and 7.10.

I found the following composition in a specimen of very clean turnings, obtained in making a division of the mass by Dr. W.

Iron,		96.000
Nickel,		3.121
Chromium,	Traces.	
Sulphur,		
Cobalt,		
Magnesium,		
		99.121

The etched surface upon a large slab of the mass, which has been forwarded for the inspection of the Meeting, by Dr. WELLS, shows it to be highly crystalline throughout, to belong to my sections of *closely crys-*

talline, alloyed, homogeneous, malleable irons. It exhibits an etched pattern, which, on the whole, more nearly resembles those of the Texas, and the Carthage, Tenn., meteoric iron; although it presents peculiarities distinguishing it from those, and from every other iron I have yet seen. It has, for instance, over much of its surface, the rather broad raised spaces situated between the sharp raised lines, (which spaces are usually dull and black,) completely filled with closely aggregated shining polygonal areas, resembling the top figures at the extremities of basaltic columns. A few narrow gashes, each about one inch long, of a brilliant pinch-beck, red pyrites appear near one extremity of the slab. The peculiar colour of this sulphuret, and the manner in which it resists the action of acids, lead to the suspicion that it may prove to be an hitherto unobserved species.

The present, therefore, is the second well-authenticated discovery of Meteoric Iron within the State of South-Carolina; and both masses have been brought to light within the space of a single year. The other mass referred to is that of Chester District, of which I presented a brief notice in the American Journal of Science, soon after the discovery was made. A fuller account of the same is reserved for a future occasion. Suffice it to remark here, that there is no such resemblance between the two, as to evince that they came from the same meteor, although they evidently belong to the same section and order of Meteoric Irons.

4. *On the falling of Meteorites over a limited zone, or area of the Earth's surface.*

From the numerous discoveries of these bodies in the States of North-Carolina, Tennessee, and South-Carolina, within the last few years, and from the many accounts of meteoric explosions, (as yet unattended by the finding of precipitated matter) over the same region, it occurred to me that there might be a concentration in the depositions of such bodies, not only on this continent, but possibly elsewhere. This idea led me to jot down upon a map of the world, the authentic falls of meteorites, which have occurred since the commencement of this century, as the best mode of bringing the conjecture to a test. The result of this investigation seems to establish the existence of such a zone or region, over which meteoric falls are more frequent than elsewhere. The facts collated are these. Out of fourteen depositions of meteoric matter on the American Continent, (during the period above referred to,) thirteen (or 92.8 p. c.) have taken place between the parallels of 33° and 44°

North latitude, while the remaining, or 1-14th, occurred at Macao, in the Province of the Rio Grande del Norte, in Brazil. Here then is presented a distribution at once exceedingly unequal. Their deposition forms an imperfect stream, whose extreme length is 11° of latitude, and whose extreme length in longitude is about 25°. The line of most frequent deposit cuts obliquely across the 37th parallel of latitude, and manifests a partial tendency of conformation to the line of the Atlantic coast.

To show that this area has actually been the scene of most frequent meteoric visitations within this period, and that the inference here made is not founded upon the fallacy, that contiguous regions have been as often struck by the fragments of meteors without, however, having been reported to science, it is only necessary to observe that the actual falls have been cited to us from districts often the most sparsely settled, while the more thickly settled States afford us no examples of meteors whatever. For instance, South-Carolina has two falls, North-Carolina two, Tennessee two, Georgia, Missouri, Iowa, Virginia, Maryland, each one; while Pennsylvania, New-Jersey, New-York, Massachusetts, Vermont, New-Hampshire, and the entire British Provinces, not a single example.

Turning now to the eastern world, where the surface is rather more than treble that of the American Continent, we have, for the same period, fifty-five falls, or rather more than four times the American number, which agrees pretty nearly with what we should anticipate, after making due allowance for the more thickly settled state of its occupation—it being just, perhaps, to leave the unexplored regions in the old and new world to balance each other.

Of these fifty-five falls, fifty (or 90.9 p. c.) have taken place over the comparatively narrow area comprehended between 41° and 56° North Latitude; and all but five, (i. e. 45 of them,) between parallels 43 and 54, a zone of the same breadth as that found to be the American region for similar falls. Of the remaining five (i. e. between 50 and 55,) three fell in Northern India, one in Finland, in latitude 60°. and the fifth at the Cape of Good Hope, in latitude 35° 5′.

The longitudinal extent of the meteoric region is here much greater than on the opposite side of the Atlantic. It extends from the sea-coast on the West, inland, and obliquely Northward for upwards of 60°;—the greatest number of falls, however, being spread over the first 30° of longitude, and the greatest concentration occurring between the parallels of 46 and 47 (of latitude.)

But it may be necessary to defend this distribution of meteor falls also

from the suspicion of the error which might arise from a defective reporting of facts, owing to supposed sparseness of population, and wan-of intelligence, over regions where no meteoric deposites are cited. On this point, suffice it to say, that while in the North of Spain, in every portion of France, in Sardinia, Lombardy, Bavaria, Bohemia, Silesia, they are most abundant, they are almost wholy wanting in Portugal, centre and southern Spain, southern Italy, Sicily and Hungary, as well as in Denmark, Sweden, Norway, and Northern Russia.

Additional evidence bearing on this point, is afforded by the localities of the meteoric iron masses, whose time of fall is wholly beyond our knowledge, their chemical composition being such as to impart to them so high a degree of persistence, that they may in particular instances, be as old as any of the solid portions of the earth's surface.

The old world has presented us with fourteen localities of these masses, eleven of which are situated within the meteoric zone, and mostly between the parallels of 46 and 52 of North Latitude. The new world has already thirty-two such discoveries, whereof twenty-two are comprised within its meteoric region, and the most of them are found near the latitude parallel of 36.

Nor can we fail to notice another curious fact connected with the inverted proportions, as regards the number of meteoric falls of recent date, and of irons, whose time of fall is unknown, for the two continents. The European has, for a given period of time, more than four times the number of the former, and less than half that of the latter. What do we recognize here, but a fresh proof of the erroneous use of the word *new*, if understood in a geological sense, as applied to our portion of the earth? The medals we are now examining add their testimony to the abundant evidence already possessed by the geologist, that, after all, we are the true denizens of the old-world.

To the question which very naturally suggests itself in this place, do these zones upon the opposite sides of the Atlantic connect by a watery region, subject to similar deposites from the atmosphere? we are wholly without evidence.

If then it appears that these aerial strangers alight upon our earth in such great preponderance over limited areas, can we help admitting that there presides over their descent some great law, or in other words, that these falls take place in accordance with some fixed plan. The present stage of our knowledge may, indeed, be inadequate to develope what that plan actuallly is; but when we see so marked an approach by the courses of our meteoric regions, to the isothermal parallels for the same

zones, and again, an observable coincidence between the trends of the meteoric regions, and the isodynamic lines, we are strongly tempted to refer the forces of greatest activity concerned in the phenomenon, to an union of thermal and magnetic action, although it is, at the same time, possible that more powerful local attractions in the surfaces concerned, than exist elsewhere, may also exert some influences over the deposition of these singular bodies.

The Association adjourned, to meet to-morrow, at 10, A. M., at the Hall of the Court of Equity.

LEWIS R. GIBBES, *Secretary.*

Fifth Day, Saturday, March 16, 1850.

MORNING SESSION.

The President took the Chair at half-past 10, A. M.

Minutes of the last Meeting were read and confirmed.

The following gentlemen, nominated by the Standing Committee, were elected members of the Association: Rev. C. Wallace, James Lamb, Esq., Henry Ravenel, Esq., Hon. Wm. Aiken, Benjamin Gardin, Esq., Charleston, S. C.; Dr. George Hay, Barnwell, S. C.; D. F. Jamison, Esq., Orangeburg, S. C.; Dr. Townsend, John's Island, S. C.; R. F. W. Allston, Esq., Georgetown, S. C.; Dr. Newman, Huntsville, Ala.; —— Malone, Esq., Athens, Ga.; Dr. Joseph Leconte, I. C. Plant, Esq., Macon, Ga.; Rev. Wm. Hall, Dr. Hamilton, Dr. J. C. Nott, Mobile, Ala.; Dr. T. P. Screven, Savannah, Ga.; —— Lane, Esq., Milledgeville, Ga.; —— Whittich, Esq., Penfield, Ga.; Lieut. Riell, U. S. N.

Standing Committee reported the following resolutions:

1st. *Resolved*, That the President of the meeting be requested to present to the Association, at their next meeting, at New-Haven, an account of the proceedings of the Charleston meeting.

2d. *Resolved*, That the Secretaries be requested to communicate to the members appointed on Committees a notice of their appointment, and to request that they will send their reports before the 1st of June to the President of the Charleston meeting.

3d. *Resolved*, That the Secretaries be requested to prepare a circular to members who have made communications at the present meeting, informing them that the rules of the Association require each one to furnish an abstract of his paper, or to transmit the communication itself, and asking that these be forwarded to one of the Secretaries within three weeks.

The Committee also recommended a recess at 1 o'clock.

Prof. Tuomey was then called to the Chair, and the first paper was read:

On the Structure of the Bones of Siren lacertina, by St. Julien Ravenel, M.D., *of Charleston, S. C,*

[Not received.]

On a new species of Menobranchus, from South-Carolina; by Prof. Lewis R. Gibbes.

This new species, *Menobranchus punctatus*, is smaller and more slender in its proportions than the two species already known, *M. maculatus* and *M. lateralis*, of a nearly uniform dark olive colour above, with numerous small orange or yellowish coloured dots, irregularly distributed over the whole surface; beneath pale flesh colour. At distant intervals over the upper surface, there are large ill-defined spots, of darker colour than the rest of the surface, but not at all approaching the distinctness of the spots in *M. Maculatus;* there are no lateral vittæ as in *M. lateralis.* The first individual obtained was discovered by Mr. Augustus Shoolbred, on the South Santee River, a few miles from its mouth, in Feb., 1848, and sent to me. Soon after, two more were sent to me from the same neighborhood, by Dr. A. Gadsden; and after the lapse of a week or two, five more were transmitted to me by Dr. Shoolbred. This gentleman sent me two more this spring, making ten in all that have been seen. None were obtained in 1849. They were all discovered in cleaning rice-field ditches, which is done once a year, at the close of the winter.

A drawing of this species was exhibited, which will probably be published with a more detailed description; drawings of the other two species were exhibited also, to illustrate the peculiarities of each.

On the Recent Squalidæ of the Coast of South-Carolina, and a Catalogue of the Recent and Fossil Echinoderms of Carolina; by Edmund Ravenel, M.D., *of Charleston, S. C.*

The interest excited by the numerous teeth of Squalidæ found in the tertiary strata of South-Carolina, induced me to collect the teeth of the species of this family, now inhabiting the sea of our immediate neighborhood.

The collection which I have made, and which is now presented to the meeting, embraces

3	species	(perhaps 4,) of	Carcharias.
2	"	"	Zygœna.
1	"	"	Galeocerdo.
1	"	"	Lamna.
1	"	"	Oxyrhina.

These Fish were all taken in the Harbour of Charleston—the Galeocerdo, and one species of Carcharias, are from the Cabinet of Mr. Holmes.

It is probable that several of these are undescribed, and the specimens now on the table, will be placed in the hands of Prof. Agassiz for his examination.

The value of local Catalogues in determining the Geographical distribution of species has been frequently alluded to at this meeting, and I therefore beg leave to lay before you a Catalogue of the Recent and Fossil Echinidæ of South-Carolina, prepared in 1848, and recently illustrated by figures of several of the new species.

This embraces the following species:

ECHINO-CIDARIS.—Desml.

1. E. punctulatus.
" Echinus punctulatus."—Lam.
Recent. So. Carolina.
My Cabinet.

2. E. infulatus.
" Echinus infulatus."—Morton.
Fossil Eocene. So. Ca.
My Cabinet.

CLYPEASTER.—Lam.

3. C. prostratus.
" Scutella gibbosa."—Ravenel.
Recent; in deep water; off the Coast of So. Ca.
My Cabinet.

SCUTELLA.—Lam.

4. S. Pileus Sinensis.—Ravenel.
Fossil. Eocene. So. Ca.
My Cabinet.

5. S. crustuloides.—Morton.
Fossil. Eocene. So. Ca.
My Cabinet.

ENCOPE.—Agass.

6. E. macrophora.
" Scutella macrophora."—Rav.
Fossil. Miocene. So. Ca.
My Cabinet.

MELLITA.—Klein.

7. M. quinquefora.
" Scutella quinquefora."—Lam.
Recent. So. Ca.
My Cabinet.

8. M. ampla.—Holmes.
New. Fossil. Post Pliocene. So. Carolina.
My Cabinet.

9. M. Caroliniana.
" Scutella Caroliniana."—Rav.
Fossil. Miocene. So. Ca.
My Cabinet.

PYGORHYNCHUS.—Agass.

10. P. crucifer.
" Nucleolites crucifer."—Morton.
Fossil. Eocene. So. Ca.
My Cabinet.

11. P. rugosus.
New. Fossil. Eocene. So. Ca.
My Cabinet.

AMPHIDETUS.—Agass.

12. A. Gothicus.
New. Fossil. Miocene. So. Ca.
My Cabinet.

BRISSOPSIS.—Agass.

13. B. poriferus.
New. Fossil. Miocene. So. Ca.
My Cabinet.

14. B. rimulatus.
New. Fossil. Eocene. So. Ca.
My Cabinet.

HEMIASTER.—Desor.
Sub-Genus.
Pericosmus.—Agass.

15. P. spatiosus.
New. Fossil. Miocene. So. Ca.
My Cabinet.

SCHIZASTER.—Agass.

16. S. atropos.
" Spatangus atropos."—Lam.
Recent. So. Ca.
My Cabinet.

In addition to these, I have recently received a species of Saganum, from the Eocene, near the Santee Canal, the single specimen being small, I will delay its description, with the hope of obtaining others.

These fossils being rare, are laid upon the table for examination.

The next paper was a communication

On the action of the Heat of the Sun upon the Earth, by Samuel Webber, Esq., *of Charlestown, N. H.*

Prof. Tuomey then read a paper,

On the Cretaceous Formation of Alabama and the Artesian Wells in that State.

No abstract of which has been received.

On the Resistance of Timber and other solids; by H. Haupt, Esq., *Supt. Penn. R. R. Harrisburg, Pa.*

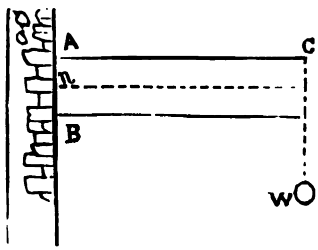
Calculations for the purpose of determining the relation which the dimensions of timbers should bear to the weights which they are required to sustain, are based upon several hypotheses, which experience has proved to be correct within the usual practical limits. The most important of these are—

1. The fibres are susceptible of compression and extension.

2. The degree of extension or compression, will be directly as the force by which it is produced.

3. So long as the elasticity remains unimpaired, or so long as the fibres may be considered as perfectly elastic, the force required to produce a given extension, will be equal to that which produces an equal compression, and the resistance to these forces will be likewise equal.

These hypotheses will be applied to the most simple ca e of flexure, which is that of determining the relations between an applied weight and the dimensions of a timber, which are necessary to sustain it when one end is fixed and the other unsupported.



Let A C represent a beam fixed at A and loaded at C with a weight (W,) the weight of the beam itself being for the present disregarded.

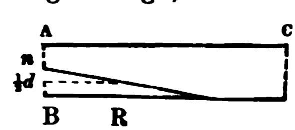
The substance of the beam is supposed to be entirely uniform throughout, and composed of an assemblage of parallel fibres, all equally strong.

The effect of the weight W is to stretch the fibres at A and compress those at B. From these points to the interior of the beam the forces gradually diminish, and there must exist some point of the line A B, at which no horizontal force is exerted, and which suffers neither extension or compression.

To that line of the longitudinal section, which passes through this point parallel to the direction of the beam A C, we have given the name of the neutral axis.

The position of the neutral axis will vary with the form of the material, with the degree of uniformity which it possesses, and with the amount of flexure caused by the load, but in a beam that is straight grained, rectangular, without knots or flaws of any kind, and not subjected to the action of a weight sufficient to impair its elasticity, it is correct to assume the position of the neutral axis in the middle of the section.

Admitting then that within the usual practical limits it is sufficiently correct to assume the position of the neutral axis in the centre of the beam, it is evident that from this line in the directions n A and n B, the pressure on the fibres will increase directly as the distance, and if the pressure upon any fibre at the distance $\frac{d}{2}$ be designated by R, the pressure upon any other fibre may be determined from a simple proportion. The total pressure upon the line n B can then be directly determined, for since the pressure upon any individual fibre is as the distance from the neutral axis, it would be represented by the perpendicular erected upon the base $\frac{d}{2}$ of a right angled triangle, whose altitude is R, and the whole pressure would be represented by the area of this triangle, or by $\frac{d}{2} \times \frac{R}{2} = \frac{Rd}{4}$.



The several forces which act upon the beam may be considered as tending either to cause, or to prevent motion around the point n, and their effects must be ascertained by comparing the products of their intensities by the distances from the point of rotation at which they act.

If, for example, a weight should be applied at the extremity of a lever, its effect would not be represented by the weight let alone, but by the weight multiplied by the distance from the fulcrum at which it acts; this product is called the moment of the force, and it is these moments in reference to the axis or point of rotation, and not simply the absolute intensities of the forces, that must be compared in determining the conditions of equilibrium in any system.

Now the weight of any body may be supposed concentrated at its centre of gravity; and, in general, any number of parallel forces may be replaced by a single force called the resultant. In the present case, the pressure of the triangle which represents the sum of all the forces upon the fibres of the lower half of the joint A B, will be the same as if a single force equal to its area were applied in the direction of a line passing through its centre of gravity.

As the centre of gravity, or centre of parallel forces of a triangle, is in a line drawn from the vertex to the middle of the base, and at a distance from the latter equal to one-third the length of the bisecting line, it follows that the leverage of the triangle of pressure will be two-thirds of $n\ B$, or $\frac{d}{3}$; this multiplied by the area of the triangle i. e. by the resisting force along $n\ B$, which we have found to be equal to $\frac{Rd}{4}$ will give for the moment of this force in reference to the point n, $\frac{Rd}{4} \times \frac{d}{3} = \frac{Rd^2}{12}$

But the part n A opposes a resistance to extension, which is equal to that which the part $n\ B$ opposes to compression, and as the moments of their forces are equal, the whole moment of the resisting forces will be expressed by $\frac{Rd^2}{6}$

The weight which is represented by w, acts with a leverage equal to l, the length of the beam and its moment will therefore be wl.

The equation of equilibrium will therefore be $wl=\frac{Rd^2}{6}$.

In this equation the breadth of the beam has been regarded as unity, but if it be represented by b, the equation will become $wl=\frac{Rbd^2}{6}$.

The value of R must be determined by experiment, and will depend upon the kind of material. In general it has been taken too high, and as a consequence, the dimensions of timbers deduced from the formula which contained it have been too small. A timber should never be subjected to a strain sufficient to destroy its elasticity; and experiments to determine the value of R, should be continued for a considerable length of time. A weight which even after several months would produce any permanent flexure, should be regarded as too great.

When a beam is used as part of a frame, the value of R must be such that only a very slight degree of flexure will take place; the limit assigned by TREDGOLD being one fortieth of an inch for every foot in length, or 1-480 of l.

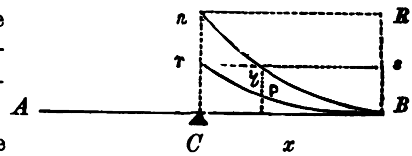
In the formula which has been obtained, it will be observed that the principle consists in representing the pressure upon a section of a beam by the volume or weight of a mathematical solid of determinate form, resting upon the section as a base, and the resultant of which is a line passing through the centre of gravity of the solid perpendicular to the plane of the section. By multiplying the force of this resultant by its distance from the neutral axis, we obtain its moment, which, in the case of equilibrium, must be equated with the product of the weight into its distance from the section of strain or fracture.

The same principle applies to any form of beam whatever, provided it be such that its volume and centre of gravity can be estimated, and by using it, the same formulæ can be obtained geometrically, that have been deduced from the summation of algebraic series, by TREDGOLD.

The solid of pressure in the case of a simple rectangular beam is a wedge; in a cylinder, it will be an ungula, having a semi-circular base, and semi-elliptical section, but the principle is general and applicable to every case.

A novel and extremely simple method is also used for determining the relative deflections of beams which consisted in representing these deflexions by the areas of plain curves. It was discovered that the deflection at any point of a beam could be represented by the ordinate of a curve, generally a common or cubic parabola, and the whole deflection equal to the sum of these ordinates, would be represented relatively by the area of a portion of the curve. An application of this principle is given in the following problems.

1. To find the deflection of a rectangular beam, supported in the middle, and uniformly loaded over its length.



Let $A\,B$ be the beam, C the fulcrum, x = distance of any perpendicular, y from the extremity B, w = weight.

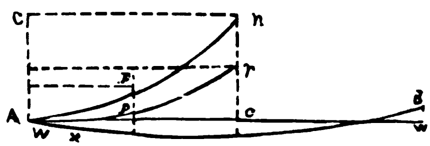
When the weight is at the extremity, the strain upon any section will be as the distance x, and will be represented by $w\,x$, but the deflection will be not only as the strain, but as the distance from B, hence it will be proportional to $w\,x^2$, or if $y = w\,x^2$, it is evident that y corresponds to the abscissa of a common parabola, whose ordinate is x, and the whole deflection equal to the sum of these abscissas, will be represented by the area $B\ Cn = \frac{1}{3}$ rectangle $B\ C\ n\ R$.

When the weight is uniformly distributed, the strain upon any section will be proportional to the weight, and distance from B.

Let x be any distance, then $l : w :: x : \frac{wx}{l}$ = weight on the part x, and $\frac{wx}{2l}.x$ = moment to which the strain or extension of the fibres will be proportioned; the deflection being as the strain and distance from B will be $\frac{w}{2l}x^3$. If then $p = \frac{w}{2l}x^3$, we perceive that p is the abscissa of a parabola of which x is the ordinate. The area $B\ C\ r = \frac{1}{4}$ of rectangle $B\ C\ r\ s = \frac{1}{8}\ B\ C\ n\ R$ = the deflection. Hence the deflection in the two cases will be as $\frac{1}{3}$ to $\frac{1}{8}$, or as 8 to 3*.

* TREDGOLD gives the proportion in this case as 3 to 5. (See Treatise on Cast Iron, page 141.) To test the question by direct experiment, the writer suspended a flexible strip of wood, 7 feet long, two uniform chains of the same length were laid upon the top, and the deflection found to be $\frac{4}{8}$ of an inch, one chain was then suspended at each end, and the deflection became $\frac{11}{8}$ of an inch, but 4 : 11 :: 3 : 8¼, a result much nearer the calculated proportion than was expected with the apparatus used.

2. The deflection of a beam supported at the ends, and uniformly loaded, will be to the deflection of the same beam, when the whole weight is on the centre, as 5 to 8.

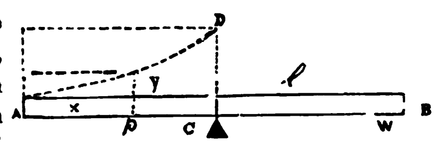


When the whole weight is at the centre, let w represent the weight upon one of the supports; the strain upon any section at the distance x will be represented by wx, and the deflection, as in the last proposition, by wx^2. It will, therefore, as in the last case, correspond to the abscissa of a common parabola, of which x is the ordinate. The sum of these deflections, or the whole deflection, will be proportional to the area $ApnC$=one-third of rectangle $Aonc$.

Let the beam be now supposed to be uniformly loaded, and let the deflection due to the extension of the fibres at the distance x be ascertained. It is evident that the weight upon the points of support will be the same as formerly. The reaction of the point A may be represented by a force equal to w acting upwards; its leverage at the distance x will be wx, and the deflection due to it wx^3, as before; but the effect of the uniformly distributed load upon the part x diminishes this deflection, since it acts in the opposite direction; its effect will be $\frac{w}{2l}x^3$, and the whole deflection will therefore be $(wx^3 - \frac{w}{2l}x^3)$. The expression $\frac{w}{2l}x^3$ is represented by the area $Ap'rc$, which we have already shown to be one-eighth of rectangle An. Hence the deflections will be as $\frac{1}{3}-\frac{1}{8} : \frac{1}{3}$, or as 5 to 8; which agrees with the results obtained by other methods.

3. To determine the extension of the fibres when a beam is supported at the ends and loaded in the middle.

A beam supported at the ends and loaded in the middle is in the same condition as a beam resting upon a fulcrum in the middle and loaded with equal weights at the ends.



Let l= one-half the whole length, w=the weight on A, x=distance of any section from A, e=the maximum extension, which will be at C.

Now, as the extension at any distance is in proportion to the strain, it will evidently be in proportion to x, and we have, therefore, $l : x :: e : \frac{ex}{l}$ = extension at the distance x. But the deflection being as the extension and distance directly, and inversely as the depth, it will be as $\frac{ex}{l} \cdot \frac{x}{d} = \frac{ex^2}{ld}$. Call this expression y; we have, therefore, $y = \frac{e}{ld}x^2$ = the equation of a parabola, of which x is the ordinate and y the abscissa.

The whole deflection being equal to the sum of these abscissas, will be represented by the area $ACD = \frac{1}{3}$ rectangle $AD = \frac{1}{3} l . (\frac{e}{ld} l^2) = \frac{el^2}{3d}$. The deflection of the part BC being equal to that of AC, the whole deflection will be $\frac{2}{3} \frac{el^2}{d}$. Whence $\frac{3d \times (\text{deflection})}{2l^2} = e$.

By observing the deflection produced by a given weight, and substituting its value in the above expression, the value of e can be ascertained. In cast iron, when the weight is 15,300 lbs. per square, it is found to be $\frac{1}{1904}$ of an inch for a length of one inch.

On the Carcinological Collections of the United States, and an enumeration of species contained in them, with notes on the most remarkable, and descriptions of new species; by Prof. LEWIS R. GIBBES.

I HAVE in the last few years visited the Cabinets of Natural History belonging to the Societies devoted to that Science in the cities of Boston, New-York and Philadelphia, and examined the collections of Crustacea contained in them. With permission of the respective Societies, I labelled their specimens in a mode nearly uniform in all, and furnished each with a Catalogue of those belonging to their Cabinet. I now propose embodying these separate enumerations in one to be laid before the Association, enlarging it in some measure by the enumeration of those in my own Cabinet, (the largest I believe at the South,) adding notes on the most remarkable species among those already described, and short descriptions of those that are new, chiefly from my own collection. These new species will be indicated by an * prefixed, and species already described, I have found it necessary to change, by a †. I shall thus endeavour

to present a view of the present state of the Carcinological Collections of the United States, and of the facilities that may be enjoyed by those studying this department of Natural History, due allowance being made for additions that may be made to collections where the proprietors are tolerably active, and losses that may be sustained by the ravages of insects, and by accidents that will occur in handling specimens so fragile as those of Crustacea. The Cabinet of the Boston Society of Natural History, was examined in 1845 and 1846; that of the Lyceum of Natural History, of New-York, in 1846 and 1847; that of the Academy of Natural Sciences, of Philadelphia, in 1847; the enumeration may be considered as representing the state of my own Cabinet at the end of 1849. These collections will be referred to as the Boston, New-York, Philadelphia and Charleston Cabinets. The American Museum in New-York has a small collection of Crustacea in good condition, and on examining it I found several species not contained in the other Cabinets; I regret therefore not having inquired for collections in public museums in other cities. These unique specimens of the American Museum are included in the following enumeration. In the rooms of the Patent Office at Washington, the collection of Crustacea of the Exploring Expedition are exposed to public view, but I sought no opportunity of studying them more closely, not regarding them as open to the public for that purpose. There were several already known species among them, which, however, I then saw for the first time, and should be glad of an opportunity to examine the collection at some future day. Only the Podophthalmian Crustacea are included in the following Catalogue, not only because I have paid less attention to the lower orders, but also because few of them are found in the collections.

To increase the value of this Catalogue, I will add the localities for the species proceeding from the Coast or Territory of the United States, distinguishing these localities by *italics*.

ENUMERATION OF CRUSTACEA.

DECAPODA.

A. BRACHYURA.

1. FAMILY OXYRHINCHA.

1. TRIBE MACROPODIANA.

LEPTOPODIA SAGITTARIA, LEACH—Philadelphia Cabinet. From the West Indies and the Gulf of Mexico, not yet positively known to inhabit the Coast of the United States.

LEPTOPODIA CALCARATA, SAY—Philadelphia Cabinet. Of SAY'S original specimen, all that remains is the stomachal region of the shell, with the eyes and rostrum attached. This was found in *Charleston Harbour*. I do not know that a second specimen has ever been found.

STENORHYNCHUS PHALANGIUM, LAMK—Boston Cabinet.

STENORHYNCHUS LONGIROSTRIS, M. EDW.—Charleston Cabinet.

INACHUS SCORPIO. M. EDW.—Boston Cabinet.

INACHUS THORACICUS, ROUX—Boston and Charleston Cabinet.

2. TRIBE MAIANA.

LIBINIA CANALICULATA, SAY—Boston, New-York, Philadelphia, and Charleston Cabinets. From the *Coast of the United States*, from Massachusetts to South-Carolina. In a collection of Crustacea brought me from Key West by Dr. WURDEMANN, there are no specimens of this crab, nor do I recollect seeing it in other collections from the same place.

LIBINIA DUBIA, M. EDW.—Boston, New-York, Philadelphia, and Charleston Cabinets. From the *Coast of the United States*—Key West to Charleston. I do not know how much further North it ranges, nor whether the specimens in each of the northern collections proceeded from the adjacent coast. DE KAY regards this as the young of the preceding, but I regard them for the present, at least, as distinct species, although it must be acknowledged no absolute character can be indicated by which they may at once be separated.

The distinctive characters are rather comparative than absolute, *L. dubia* is more pyriform and less circular in outline, as viewed from above, than the preceding; the central region of its shell is less depressed, and the spiniform tubercles fewer; or more accurately, what may be termed the spines proper, on the surface of the shell and around its lateral edges, are, with few exceptions, precisely the same in number and position in both species, but *L. canaliculata* has in addition, a number of spiniform tubercles, appearing like undeveloped spines, distributed between the spines proper. These differences are not those of sex, for I have males and females of both forms; nor of locality, for I have both forms from Charleston Harbour; nor of age, at least, not of size merely, as my specimens exhibit all ranges of sizes for each set of characters. Possibly, the internal anatomical details would furnish some distinctive character. *L. dubia* appears to be the most prevalent form along the southern coast.

Libinia affinis, Randall—Philadelphia Cabinet. This so closely resembles *L. dubia*, that if from the Atlantic coast, I should not regard it as different, but as it comes from Upper California, I cannot venture to pronounce them the same.

Herbstia parvifrons, Randall—Philadelphia Cabinet. From Western Coast of America.

Pisa tetraodon, Leach—Boston, New-York, and Charleston Cabinets. From the Coast of Europe.

Pisa bicorna. Boston, New-York, and Charleston Cabinets. My specimens are from *Key West*, where it appears to be common. Shell triangular, tuberculous, branchial regions developed, and each armed with a single moderate spine; rostrum of moderate length, horns diverging from their base; terminal tooth of the basilar segment of the external antennæ prominent, surpassing in length the anterior angle of the upper orbitar edge; ocular peduncles not closely sheathed by the orbits but capable of being folded back; lower orbitar edge with a notch, which is smaller in proportion than in the *P. tetraodon*; claws or first pair of feet, in the male with large hand, finger and thumb, when closed, touching by their sharp finely serrated edges at their tips, and leaving a wide opening between them elsewhere, as in *P. tetraodon*; body covered moderately with a brownish down, hands bare, and marked with reddish brown spots, (in the dry specimen,) on a light ground. In the female, first pair of feet but little larger than the rest, finger and thumb in closing, fitting nearly accurately. This species I regard as the *Pericera bicorna* of

Milne Edwards, and have so labelled it in some of the collections, but it will be seen by the description that it really belongs to the genus *Pisa.*

* Pisa mutica—Charleston Cabinet. This small species was found in *Charleston Harbor*, off White Point Battery. Length of rostrum, reckoned from interantennary spine, one-fourth the length of the rest of the body, horns united for the lower third, diverging afterwards; body triangular, without tubercle or spine, of moderately uniform convexity, stomachal region somewhat developed; eyes capable of folding back, the orbit incomplete, especially on the lower side, no spine on the upper orbitan edge; basilar segment of the external antennæ narrow, without any spine, and the antennæ visible on each side of the rostrum when viewed from above. Length 0.45 of an inch from tip of rostrum to posterior edge of carapace. Female with eggs.

Lissa fissirostra, Say—Boston, Philadelphia and Charleston Cabinets. *Northern coast of United States*, as far south as Long Island, according to DeKay. Although the form of the rostrum forbids our retaining this species in the genus *Lissa*, I continue to use Say's original name, as I have had no opportunity of comparing it with *Hyas coarctata* from the British coast, with which some of our naturalists regard it as identical. It appears to me to resemble *Hyas aranea*, judging from Herbst's figure. The first segment of the moveable portion of the external antennæ is very slightly enlarged externally.

* Hyas aculeata—Boston and Charleston Cabinets. Brought *from Key West* by Dr. Wurdemann, *from Florida* by Mr. Bartlett. Body sub-rotund, convex, somewhat tuberculous above in the female, smooth and polished in the only male specimen I have, lateral edges armed with five spines on each side, not including the angles of the orbits, the middle spine and the one anterior to it sometimes appearing united, forming a bifurcated spine, particularly in the male; orbits directed forwards and outwards, with a spine at outer angle, two at the inner, one above and one below, an obsolete fissure at the upper edge of the orbit, and another at the lower; first moveable segment of the external antennæ flat, broad, extended into a wing externally, which also projects forwards for half the length of the next segment, and both segments clothed with ciliæ; rostrum bifid, short, barely the length of the first segment of the external antennæ; third segment of the external jaw-feet dilated outward at the external angle. Length one inch.

CHORINUS HEROS, LEACH—New-York, Philadelphia and Charleston Cabinets. *From Key West.* The specimens I have labelled thus in the collections are nearly uniform in size and appearance, agree in the main with the description of M. EDWARDS, but are little more than an inch in length, with the first pair of feet scarcely reaching to tip of rostrum. They may be the young, or it is possible that they form a distinct species; but I will not venture to decide without a further supply of specimens.

MITHRAX SPINOSISSIMUS, M. EDW.—Philadelphia and Charleston Cabinets. My specimens are *from Key West.* An individual in the Philadelphia collection is of unusual size. Shell 7 inches in length, as many in breadth, and 3 inches thick; hand and finger 7 inches long, 2 1-2 broad; whole length of one of the first pair of feet 13 inches. Several fine specimens of this crab in the American Museum, New-York.

MITHRAX VERRUCOSUS, M. EDW.—Boston and Charleston Cabinets. My specimens are *from Key West.*

MITHRAX HISPIDUS, M. EDW.—Boston, New-York, Philadelphia and Charleston Cabinets. Those in the Boston Cabinet were brought *from Florida* by Mr. BARTLETT; the one in my own (a young male) was *taken off Charleston Harbor.*

MITHRAX SCULPTUS, M. EDW.—Boston, New-York, Philadelphia and Charleston Cabinets. My specimens are *from Key West,* where it appears to be very common.

MAIA VERRUCOSA, M. EDW.—Boston, New-York and Charleston Cabinets.

MICIPPA CRISTATA, LEACH—New-York Cabinet. This species is rare in our cabinets, there being only a single shell at New-York.

PERICERA CORNUTA, M. EDW.—Boston, Philadelphia and Charleston Cabinets. There is also a specimen in the American Museum, New-York. That in my Cabinet came *from Key West.* The specimen in the Philadelphia Cabinet has been described by Dr. RANDALL (Jour. Acad. Nat. Sci., vol. viii, p. 108,) as new under the name of *Chorinus armatus;* his description will be found to apply to *Pericera cornuta* in every respect, and a reference to the figure given in HUGHES' Natural History of Barbadoes, pl. 25, fig. 3, or to HERBST, pl. 59, fig. 6, will complete the proof that it has been already described.

PERICERA TRISPINOSA, M. EDW.—Charleston Cabinet. *From Key West,* brought by Dr. WURDEMANN.

ACANTHONYX LUNULATUS, M. EDW.—Boston and Charleston Cabinets.

EPIALTUS BITUBERCULATUS, M. EDW.—Charleston Cabinet. Brought *from Key West* by Prof. W. H. HARVEY, and agrees perfectly with MILNE EDWARDS' description and figure of individuals said to come from the coast of Chili.

EPIALTUS PRODUCTUS, RANDALL—Philadelphia Cabinet.

EPIALTUS NUTTALII, RANDALL—Philadelphia Cabinet. *From Upper California.* A single shell of *E. Nuttalii* is in the New-York Cabinet. These two species appear to be new and well-marked.

3. TRIBE PARTHENOPIANA.

LAMBRUS LONGIMANUS, LEACH—Boston Cabinet.

LAMBRUS ANGULIFRONS, M. EDW.—New-York Cabinet.

LAMBRUS ECHINATUS, M. EDW.—Philadelphia Cabinet and American Museum, New-York.

LAMBRUS MEDITERRANEUS, ROUX—Boston and New-York Cabinets.

PARTHENOPE HORRIDA, LEACH—Philadelphia Cabinet.

CRYPTOPODIA FORNICATA, M. EDW.—Boston Cabinet. Shell in outline triangular, with the lateral angles much rounded, and the posterior edge, the base of the triangle, nearly straight, latero-anterior edges dentate; from each orbit a ridge runs backwards, curving outwards, and becomes effaced before reaching the edge of the shell, and from these two ridges the surface of the shell slopes down outward and forwards; at the middle of the length of the shell a transverse ridge connects these, and from it the surface of the shell slopes backwards; third segment of first pair of feet dilated towards articulation, with carpus, dentated on anterior edge; hand triangularly prismatic, upper and outer edges lamellar, with prominent and distant teeth; third segment of the other feet furnished with lamellar lanciniate teeth, only the second and third pair when extended, exhibiting their tips beyond the vaulted edge of the shell. This description of a well-known species is given to introduce more distinctly the following new one from our own coast.

* CRYPTOPODIA GRANULATA—Charleston Cabinet. Shell triangular, with the lateral angles sharp, middle two-thirds of posterior edge prominent in a regular curve, latero-anterior edges slightly crenate; ridges from the orbits running back but a third of the length of the shell, and meeting with a short transverse ridge; from the two extre-

mities of this, two ridges run backward, parallel with the latero-anterior edges of the shell. until they reach the posterior edge at the two extremities of its curved portion, and with it circumscribe a sub-triangular space, in the centre of which is a tubercle; third segment of first pair of feet not at all dilated, or but slightly so; the four other pair without spines, and when folded, wholly concealed under the lateral arches of the shell—when extended, exhibiting their two last segments; upper and outer edges of the hand, which is triangularly prismatic, granulate, as also the posterior edge of the shell, the two ridges running to it, the transverse ridges of the segments of the abdomen, and other lines on the body. Rostrum lamellar short, but well-marked. Length 0.45 of an inch, breadth 0.60; length of preceding species an inch and a half nearly, breadth two and a half. The first specimen of this species was obtained by Dr. T. L. Burden, of Charleston, near Kiawah Island, drawn up on a bit of sponge by a hook and line; a second was found by myself at the eastern end of Sullivan's Island, the day after the gale in October, 1848, and a third and fourth I obtained on the 18th August, 1849, at *White Point Shoal, Charleston Harbor;* of these, two were females, of the size given above—the others, males, of only half those dimensions. Abdomen of seven segments in both sexes.

2. FAMILY CYCLOMETOPA.

1. TRIBE CANCERIANA.

Cancer limbatus, M. Edw.—Philadelphia Cabinet.

Carpilius corallinus, M. Edw.—Boston, New-York, Philadelphia and Charleston Cabinets. From the West Indies.

Carpilius maculatus, M. Edw.—New-York Cabinet. From the West Indies.

Carpilius convexus, Ruppell—New-York Cabinet. Ruppell's specimens were from the Red Sea.

* Carpilius lividus.—This small species is in the New-York Cabinet, sent from the Sandwich Islands. Shell dark livid or purple color when taken out of spirits, moderately convex, smooth without fur rows, slightly punctate; middle portion of the frontal edge slightly prominent; latero-anterior edges obtuse, terminated behind by an obtuse tooth or tubercle; length three-fourths of an inch.

* Carpilius prætermissus.—Specimens of this species are in the

Boston, New-York and Charleston Cabinets, and I have more than once seen them in the small cases of Chinese insects brought to this country, but have not been able to find either figure or description of it in any of the works to which I have access; these are so few as perhaps hardly to warrant the step I have taken—that of imposing a name on it. Shell arched anteriorly, narrowed posteriorly, convex longitudinally, smooth and polished, with no distinction of regions, marked with about 25 reddish colored spots distributed symmetrically on a light ground; latero-anterior edges obtuse, without dentation of any kind, and wanting even the rounded tubercle, in which they terminate in the other species of the genus; front with a minute fissure, curved in outline, so as to present four lobes very slightly prominent, and marked transversely with a punctate line; orbits oval, without tooth or fissure; the hiatus between their lower edge and the front filled by the basillar segment of the exterior antennæ, which joins the front, the moveable peduncle lying in the fissure; hands robust, moderately compressed, punctate, without crest, spine or tubercle, fingers trenchant, not spoon-shaped; four last pair of feet compressed, without crest or spines, marked with spots like the body.

Lagostoma nodosa, Randall—Philadelphia Cabinet, Sandwich Islands.

Xantho floridus, Leach—Boston and New-York Cabinets.

Xantho rivulosus—M. Edw.—Charleston Cabinet.

* Chlorodius Floridanus—Charleston Cabinet. Brought *from Key West* in numbers, by Dr. Wurdemann in 1845, and lately by Prof. W. H. Harvey. Shell depressed, broader than long, rendered uneven by low prominences, separated by shallow groves, these prominences or flat knobs marked with transverse plications; front, of two truncated lobes, separated by a fissure, anterior edge of lobes grooved; latero-anterior edges armed with five triangular teeth pointing forwards, the anterior one forming the angle of the eye; basal portion of external antenna filling the hiatus and touching the front, the peduncle being lodged in the hiatus; third segment of the anterior feet short, just reaching edge of shell, carpus and hand, stout in the male, somewhat corrugated, spotted with red, finger and thumb brownish black, toothed on their opposing edges, spoon shaped at tip, with a tuft of hair in the cavity; other pairs of legs villose; third segment of foot jaws slightly notched on its anterior edge. Length 0.75 of inch, breadth 1.10 of inch.

Panopeus Herbstii, M. Edw.—Boston, New-York, Philadelphia

and Charleston Cabinets. Common on *Coast of New-York*, according to DEKAY; common in *Charleston Harbour;* brought me *from Key West* by Dr. WURDEMANN.

PANOPEUS LIMOSUS, M. EDW.—Philadelphia and Charleston Cabinets. *Coast of New-York*, DEKAY; I have obtained them on the coast of *South-Carolina*, and have them from *Smyrna*, *Fla.*, and from *Key West.*

* PANOPEUS WURDEMANNII—Charleston Cabinet. Brought me from *Enterprize*, *Fla.*, by the late Dr. F. WURDEMANN, who recognized as distinct from *P. Herbstii*, the young of which it most nearly resembles, and whose females are also frequently found carrying their eggs in the usual manner, when not larger than the present species. This species is, however, easily distinguished; the anterior edge of the front is marked by a grove, (not apparent in either of the preceding species,) whose borders are formed by finely granulated ridges; the surface of shell also is marked by a few distinct transverse ridges, which never appear so well marked in *P. Herbstii*, even when of larger size; the finger and thumb in this species are white; length 0.5 of inch, breadth 0.7 of inch.

PSEUDOCARCINUS RUMPHII, M. EDW.—Boston and Charleston Cabinets; also, in the American Museum, New-York.

†PSEUDOCARCINUS MERCENARIUS—Boston, Philadelphia and Charleston Cabinets. This is the *Cancer mercenaria* of SAY, (Jour. Acad. Nat. Sci., vol. i, p. 448,) abundant along our Southern Coast, from *Charleston Harbour to Key West*, and known as the Stone Crab. It is referred by MILNE EDWARDS, with some doubt, to the genus *Xantho*, of LEACH, (M. EDW. Hist. Crust.. tome i, p. 399,) and also by DEKAY, (New-York Fauna, Crustacea, p. 4,) and I have so labelled it in the Boston Cabinet; but I have no hesitation in referring it to M. EDWARDS' own genus *Pseudocarcinus*, and feel confident he had it before him when writing his description of *Pseudocarcinus ocellatus*, (op. cit., p. 409.) His description applies in every particular, but is short. The country of his specimens he says is unknown.

ETISUS LÆVIMANUS, RANDALL—Philadelphia Cabinet.

PLATYCARCINUS PAGURUS, M. EDW.—The only specimen of this species that I have seen, is in the American Museum in New-York, apparently of full dimensions, 5 or 6 inches in length, 8 inches in breadth.

PLATYCARCINUS IRRORATUS, M. EDW.—Boston, Philadelplia and

Charleston Cabinets; also, in the American Museum, New-York. This is the *Cancer irroratus* of SAY, or rather what he regarded as the female of the species so named by him. It is found on the coast of the New-England States, I have not met with it at the south.

PLATYCARCINUS SAYI, DEKAY—Boston, New-York and Charleston Cabinets. This species was regarded by SAY as the male of his *Cancer irroratus*, and was separated from that species by Dr. A. A. GOULD, as *Cancer Sayi*. I have collected it on the *Coast of Massachusetts*, and on the *Coast of New-Jersey;* I have also a specimen taken by fishermen off *Charleston Harbour*, and have seen one other specimen taken on the *Coast of South-Carolina.*

PLATYCARCINUS PRODUCTUS, RANDALL—Philadelphia Cabinet. A distinct species from the three others, brought from the Western Coast of North America.

PILUMNUS ACULEATUS, M. EDW.—Philadelphia and Charleston Cabinets. The *Cancer aculeatus* of SAY. My specimens are from the *Coast of South-Carolina*, inhabiting sponges, &c.

PILUMNUS VILLOSUS, RISSO.—Charleston Cabinet.

ERIPHIA SPINIFRONS, LATR.—Boston, New-York and Charleston Cabinets.

ERIPHIA GONAGRA, M. EDW.—Boston, Philadelphia and Charleston Cabinets. My specimens are *Key West*, whence Dr. WURDEMANN brought me several.

TRAPEZIA CYMODOCE, GUERIN—Philadelphia and Charleston Cabinets.

2. TRIBE PORTUNIANA.

CARCINUS MÆNAS, LEACH—Boston, New-York, Philadelphia and Charleston Cabinets. *From the Coast of New-England States.*

PLATYONICHUS OCELLATUS, LATR.—Boston, New-York, Philadelphia and Charleston Cabinets. Dr. GOULD enumerates it among the Crustacea of *coast of Massachusetts*, I have collected it on the *coast of New-Jersey*, and on the *coast of South-Carolina*, and a single specimen was brought me from *Key West.* It is the *Cancer ocellatus* of HERBST, and the *Portunus pictus* of SAY.

PORTUNUS PUBER, LEACH—New-York Cabinet.

PORTUNUS PLICATUS, M. EDW.—Boston and Charleston Cabinets.

PORTUNUS MARMOREUS, LEACH—New-York and Charleston Cabinets.

PORTUNUS CORRUGATUS, LEACH—Boston and Charleston Cabinets.

PORTUNUS RONDELETII, RISSO—Boston and Charleston Cabinets.

LUPA TRANQUEBARICA, M. EDW.—Boston and New-York Cabinets.

LUPA DICANTHA, M. EDW.—Boston, New-York, Philadelphia and Charleston Cabinets. Inhabits *coast of Massachusetts*, according to GOULD; I have seen it in abundance in the markets of *New-York and Philadelphia;* it abounds in *Charleston Harbour*, and I have specimens from *Key West.* Demerara is the most southern point from which I have seen it. In the specimens from Charleston Harbour and northwards, the middle spines of the front are obsolete, but distinct in those from Key West and Demerara. This crab is the *Lupa hastata* of SAY.

† LUPA SAYI—Boston and Charleston Cabinets. This crab is not uncommon on the *coast of South-Carolina*, whence my specimens proceed, and I regard it as the *Lupa pelagica* of SAY, but as it is not the *Lupa pelagica* of LEACH, MILNE EDWARDS and others, I have attached to it the name of its first describer; his description applies perfectly to it, but the specimen to which his original label is affixed in the Philadelphia Cabinet, does not belong to this species; perhaps some interchange of labels has taken place. DEKAY, in the Fauna of New-York, pl. 6, fig. 8, gives a recognizable figure of it, but that will scarcely give an adequate idea of the beauty of its coloration when first taken from its native element.

LUPA CRIBRARIA, M. EDW.—Philadelphia and Charleston Cabinets. *From coast of South-Carolina and from Key West.* This is the *Lupa maculata* of SAY, and appears to be the same as LAMARCK'S *Portunus cribrarius*, and as the latter specific name is the prior one, I have retained it.

LUPA SPINIMANA, LEACH—Boston Cabinet, and also in the American Museum, New-York.

LUPA RUBRA, M. EDW.—Philadelphia and Charleston Cabinets. My specimens are from *Key West*, by Dr. WURDEMANN.

LUPA FORCEPS, LEACH—New-York Cabinet.

THALAMITA PULCHRA, RANDALL—Philadelphia Cabinet, appears to be very near *T. erythro-dactyla*—M. EDW.

PODOPHTHALMUS VIGIL, LEACH—Philadelphia and Charleston Cabinets. From the Sandwich Islands.

3 FAMILY CATOMETOPA.

3. TRIBE THELPHEUSIANA.

THELPHEUSA FLUVIATILIS, LATR.—New-York and Charleston Cabinets. From the Mediterranean.

THELPHEUSA INDICA, LATR.—Boston Cabinet,

POTAMIA DENTATA, LATR.—Boston and Philadelphia Cabinets. The *Boscia dentata* of M. EDWARDS,—*Potamia* is the prior name.

POTAMIA LATIFRONS, RANDALL—Philadelphia Cabinet. Distinct from *P. dentata*, LATR.

TRICHODACTYLUS QUADRATUS, M. EDW.—Boston Cabinet.

2. TRIBE GECARCINIANA.

ORTHOSTOMA DENTATA, RANDALL—Philadelphia Cabinet. A distinct genus, but I do not feel confident that it has its proper place in the systematic arrangement.

UCA UNA, LATR.—New-York and Philadelphia Cabinets.

CARDISOMA CARNIFEX, LATR.—Philadelphia Cabinet.

CARDISOMA GUANHUMI, LATR.—Boston, New-York, Philadelphia, and Charleston Cabinets. My specimens are from *Key West*, *Fla.*

GECARCINUS RURICOLA, LATR.—Boston, New-York, Philadelphia and Charleston Cabinets.

GECARCINUS LATERALIS, M. EDW.—Boston and Philadelphia Cabinets.

3. TRIBE PINNOTHERIANA.

PINNOTHERES OSTREUM, SAY—New-York and Charleston Cabinets. From the *Coast of New-York* and *Coast of South-Carolina*, most probably its range is from Cape Cod to Key West.

PINNOTHERES MACULATUS, SAY—New-York and Charleston Cabinets. From *Coast of New-York* and *Coast of South-Carolina*. Pinnotheres is masculine, but SAY, misled perhaps by the termination in the European species *P. pisum*, everywhere regards it as neuter. The accent is on the penult.

PINNOTHERES BYSSOMIÆ, SAY—Philadelphia Cabinet; SAY's original specimen and label.

4. TRIBE OCYPODIANA.

OCYPODE ARENARIA, SAY—Boston, Philadelphia, and Charleston Cabinets. My specimens are from the *Coast of South-Carolina* and from *Key West.*

OCYPODE RHOMBEA, M. EDW.—Boston Cabinet.

OCYPODE FABRICIUS, M. EDW.—New-York Cabinet.

GELASIMUS PLATYDACTYLUS, M. EDW.—Philadelphia and Charleston Cabinets.

GELASIMUS VOCANS, M. EDW.—Boston, New-York, Philadelphia, and Charleston Cabinets. *Coast of Atlantic States*, from Massachusetts to Key West. I do not know whether those inhabiting our coast, those inhabiting the West Indies, and those proceeding from Brazil, form one species, as M. EDWARDS appears to regard them, or as several, as others appear to have arranged them, not having had the means of effecting a comparison.

5. TRIBE GONOPLACIANA.

PSEUDORHOMBILA QUADRIDENTATA, M. EDW.—The only specimen of this crab that I have seen is in the American Museum in New-York —a fine specimen.

GONOPLAX RHOMBOIDES, DESM.—Boston and Charleston Cabinets.

MACROPHTHALMUS COMPRESSIPES, RANDALL.—Philadelphia Cabinet. Distinct from the other species of the genus. *M. podolphthalmus* of the voyage of the Bonite is a synonyme of this species.

6. TRIBE GRAPSIANA.

SESARMA AFRICANA, M. EDW.—Boston Cabinet.

SESARMA RECTA, RANDALL—Philadelphia Cabinet.

SESARMA RETICULATA, SAY—Boston, New-York, Philadelphia, and Charleston Cabinets. Those in the Philadelphia Cabinet were said to have been found on the *Coast of New-Jersey.* I have obtained them on the *Coast of South-Carolina*, and I have specimens *from Key West.* In South-Carolina they are by no means as abundant as the next species.

SESARMA CINEREA, SAY—Boston, New-York, Philadelphia, and Charleston Cabinets. This is the *Grapsus cinereus* of Bosc. Abundant *in Charleston Harbour*, and exists also *at Key West.* MILNE

Edwards, (op. cit, tome, ii. p. 75, note) confounds this species, and the preceding, and so does DeKay, (New-York Fauna, Crustacea, p. 15,) but they are quite distinct and readily distinguished; *S. reticulata*, has a thicker body than *S. cinerea*, and is every way more robust; the latter has no tooth behind the exterior angle of the orbit, the former, a small but very perceptible one, sometimes becoming quite prominent, and also a granulated line on the crest of the hand, which is wanting in the latter. This enables me to say that Dr. DeKay, while writing his description of *S. cinerea*, had *S. reticulata* before him, and probably the want of specimens of both species, prevented him from seizing the distinctive characters.

Sesarma Pisonii, M. Edw.—Boston, New-York, and Charleston Cabinets. My specimen was sent me *from Key West*, by S. R. Mallory, Esq.

Grapsus cruentatus, Latr.—Boston, Philadelphia, and Charleston Cabinets—also, in the American Museum, New-York. The specimens in my Cabinet are *from Key West.* Those in the Philadelphia Cabinet are said to be from Surinam, and being regarded by Dr. Randall as new, were described by him as *G. longipes.* (Jour. Acad. Nat. Sci. vol. viii. p. 125.) In my note on this species, appended to the Catalogue sent to the Academy, I see, that in seeking for a reason for the error of Dr. R., I have committed the strange mistake of regarding Surinam as not a locality for this species; as it is an inhabitant of the West Indies and Brazil, I can perceive no reason why it should not inhabit Surinam.

Grapsus lividus, M. Edw.—Boston and New-York Cabinets. The specimen in the Boston Cabinet was brought *from Florida*, by Mr. Bartlett.

Grapsus pictus, Latr.—Boston, New-York, Philadelphia and Charleston Cabinets. My specimen is *from Key West.*

Grapsus rudis, M. Edw.—Philadelphia Cabinet. From the Sandwich Islands. This is the same as *G. hirtus* of Randall, and M. Edwards' name is the prior one. With him I regard *G. rudis* as distinct from *G. pictus*, though it differs only in the following particulars: The shell is clothed with numerous but distinct transverse lines of hairs; the front is not so perpendicularly turned down, the four lobes of the front are more tuberculous, and the limbs are smaller when compared with the body.

Grapsus varius, Latr.—Boston Cabinet.

* Grapsus transversus.—Boston and Charleston Cabinets. This

species was brought me *from Key West*, by Dr. WURDEMANN, in 1845, and lately by Prof. W. H. HARVEY, from the same place, where it appears to be common. Those in the Boston Cabinet were, I believe, also brought from Florida by Mr. BARTLETT. Shell broader than usual in the genus, and narrowed posteriorly, the length being only three-fourths the breadth, with a well marked tooth on each side, behind that which forms the external orbitar angle, marked with many transverse slightly elevated lines of fine granules, of a darker color than the rest of the shell, producing the appearing of fine plications; several of those lines converge to the lateral tooth on each side, they are most distinct on the anterior portion of the shell, and become obsolete on the hinder part; front, a little more than half the breadth of the shell sloping gently downwards and forwards, edge slightly sinuous as if bilobate, marked above with the four elevations peculiar to the genus, moderately developed; third segment of the exterior jaw-feet dilated and rounded on the outer side; hands smooth polished, with a corrugated area on the crest, and an elevated line on the outside near the lower edge, running to the tip of the finger. By these characters, it will be seen that it belongs to M. EDWARD's second division of the genus, or RANDALL's genus, *Pachygrapsus*, if that be adopted.

PACHYGRAPSUS CRASSIPES, RANDALL.—Philadelphia Cabinet.

PACHYGRAPSUS PARALLELUS, RANDALL.—Philadelphia and Charleston Cabinets. These appear to be distinct from the described species of the genus *Grapsus*.

NAUTILOGRAPSUS MINUTUS, M. EDW.—Boston, New-York, Philadelphia and Charleston Cabinets. This is the *Grapsus cinereus* of SAY, described in Jour. Acad. Nat. Sci. vol. i., p. 99, supposing it to be the *Grapsus cinereus* of Bosc.; on p. 449, the name is changed by him to *G. pelagicus*, on finding the true *G. cinereus* of Bosc, the *Sesarma cinerea* of late writers. This species has never been found on our coast, as far as I am aware, but it is not uncommon in the *Gulf Stream*, off the coast, *from the Gulf of Mexico to New-York*, clinging to marine animals and vegetables.

PLAGUSIA CLAVIMANA, LATR.—New-York and Philadelphia Cabinets. In the Philadelphia Cabinet there are young individuals brought from Santa Cruz, by Dr. R. E. GRIFFITH, and one individual said to be from the Pacific; no perceptible difference existed between those from different localities.

PLAGUSIA SQUAMOSA, LAMK.—Boston, New-York, Philadelphia and Charleston Cabinets. My specimens are *from Key West*, brought by

Dr. WURDEMANN, and *from Charleston Harbor*, obtained by Dr. EDMUND RAVENEL on the Breakwater on Sullivan's Island, three or four years since. It seems to have made its appearance on our coast, or at least on that of Sullivan's Island, only since the construction of the Breakwater, as it never presented itself before to Dr. RAVENEL, during a residence of more than twenty successive summers. This is the *P. depressus* of SAY, but not the *P. depressa* of other authors. I have never seen specimens of the *P. squamosa* of the Red Sea and Indian Ocean, to ascertain by comparison how far it differs from that species, but it agrees so completely with the descriptions and figures of it that I will not decide to separate it. If distinguished from that, it will take the name *P. Sayi*, assigned to it by Dr. DEKAY.

4. FAMILY OXYSTOMA.

3. TRIBE CALAPPIANA.

CALAPPA GRANULATA, FABR.—Boston and New-York Cabinets.

CALAPPA MARMORATA, FABR.—Boston, Philadelphia and Charleston Cabinets; also in the American Museum, New-York. The specimens in my Cabinet are *from Key West*, where they are called Box Crabs, as I was informed by Dr. WURDEMANN, who brought them. I have also a specimen, said to have been taken by fishermen *off Charleston Harbor.*

CALAPPA LOPHOS, FABR.—Boston Cabinet.

CALAPPA CRISTATA, FABR—Boston and Philadelphia Cabinets.

CALAPPA TUBERCULATA, FABR.—Philadelphia and Charleston Cabinets.

PLATYMERA GAUDICHAUDII, M. EDW.—Boston and New-York Cabinets.

ORYTHIA MAMILLARIS, FABR.—The only example of this species that I have seen is a very good specimen in the American Museum, at New-York.

HEPATUS FASCIATUS, LATR.—Boston, New-York, Philadelphia and Charleston Cabinets.

* HEPATUS DECORUS—Charleston Cabinet. I have for several years past, separated, under the above name, this species from the preceding, with which it undoubtedly has been confounded by carcinologists, except HERBST. It is *common in Charleston Harbour*, and at times its exuviæ are abundant on the beaches. I have specimens of all sizes, from half an inch in length up to two inches, exhibiting the series of changes it

undergoes as it advances in age. The two species, *H. fasciatus* and *H. decorus*, resemble each other closely in the size and form of the body and the dentation of its latero-anterior edges, in the form and armature of the carpus and hand, and in the form and colored markings of the four hinder pair of feet. They differ in the markings of the shell. In the *H. fasciatus*, (of which I have only seen adult individuals,) the spots, which are deep red on a pale ground, are small and distributed in transverse bands slightly convex forward, or, in some specimens, are broken up into smaller spots and dots, and scattered irregularly over the whole surface. In *H. decorus*, the spots, in adult individuals, are large, of a light red color, bordered with a deeper tint of red, and symmetrically disposed on the two sides of the shell; this longer diameter, when not circular, being frequently in the direction of the length of the shell, In young individuals, or at least smaller ones, the spots still retain their large size compared with that of the shell, the same character of coloration, that is, a pale disk, with darker border, but their longer diameter is transverse, and they are so arranged as to run in transverse curved bands, with the convexity forwards, and occasionally their extremities run one into another, so that they form a continuous band from one side of the shell to the other; the transition from the latter of these forms to the former can be easily traced when a number of shells of different sizes are compared. In *H. decorus* there are on each of the branchial regions on the two sides two transverse *lines* of granules, separated by a wide space, the anterior one being the longer; these are most distinct in small specimens, and become less so in the larger, and not unfrequently are entirely effaced. In *H. fasciatus*, in the same positions, there are *groups* or *patches* of granules irregularly distributed and well-marked in the large individuals; DESMAREST'S figure (Consid. Gen. Crust., pl. 9, fig. 2,) exhibits the position of these groups and the distribution of the granules. In *H. fasciatus* there is a granulated ridge running from the external angle of the eye outwardly to the denticulated edge of the shell, quite distinct in the older individuals. In the *H. decorus* this ridge is equally distinct in young individuals before the change in the markings of the shell has taken place; afterwards it becomes fainter, and in some full-sized specimens no trace of it is left. These characteristics indicate that there are two distinct species, and that *H. fasciatus* is the lower form of the two, since it retains in adult age the characters presented by the other only in its early stages. It is proper to add that I have never seen an individual of *H. fasciatus* on our coast, where *H. decorus* is common. This is undoubtedly the *Can-*

cer decorus of HERBST—Naturgeschichte der Krabben und Krebsen, Band ii, s. 154, Tab. 37, fig. 6—and I am glad to be able to establish one of the species of that industrious collector, long overlooked by carcinologists; MILNE EDWARDS makes no reference to it. The *Platycarcinus decorus*, indicated on page 29 of the Bulletin of Proceedings of the Academy of Natural Sciences of Philadelphia, by the committee on my catalogue of the Crustacea in their Cabinet, is, I have no doubt, the *Hepatus decorus*. HERBST says that unfortunately he had only a shell of this crab, and that its fatherland is unknown.

HEPATUS CHILIENSIS, M. EDW.—New-York Cabinet.

2. TRIBE LEUCOSIANA.

LEUCOSIA URANIA, LEACH—Boston Cabinet.

LEUCOSIA CRANIOLARIS, LEACH—New-York Cabinet.

ILIA NUCLEUS, LEACH—Boston, New-York and Charleston Cabinets.

* ILIA ARMATA—New-York Cabinet. This new and well-marked species I found in the Cabinet of the Lyceum of Natural History of New-York, and presented a description to be published in their proceedings, which I will here transcribe. Body sub-globose, sub-circular in outline, with posterior edge lamellar, straight, projecting with the angles slightly rounded, surmounted by a single large sub-lamellar, acutely-pointed dentiform process, slightly curved upwards at top; surface of shell granulate granules, most distinct on anterior and lateral parts, and on upper surface of the tooth or process above mentioned; anterior feet moderately long, nearly twice the length of body, slender, third segment tapering from the articulation near the body to the other, granulate granules largest near the body and on the upper surface, carpus short, hands long, slender, tapering to articulation of finger, finger and thumb filiform, the former articulated in a direction at right angles to that of the carpus and hand; legs of four last pair slender, with long and slender tarsi; abdomen having the fourth, fifth and sixth segments in one, in the only individual seen, a female; length of body one inch; country unknown.

GUAIA PUNCTATA, M. EDW.—Philadelphia and Charleston Cabinets; also in the American Museum in New-York. My specimens are *from Charleston Harbour;* I have found it also abundant on the *coast of Georgia.* This crab has been frequently confounded with *Ilia punctata* of MILNE EDWARDS, the *Leucosia punctata* of previous writers, for want of attention to the slender fingers and to the peculiar contorted

form of the hands in the genus *Ilia*. The *Leucosia punctata* mentioned by SAY, (J. A. N. S., vol. 1, page 458,) as very common on the Southern coasts, and the *Ilia punctata* of DEKAY, (op. cit., p. 17,) are undoubtedly *Guaia punctata*, and must rank as its synonymes. The country of the true *Ilia punctata* of M. EDW. appears to be unknown. I have not been able to obtain access to a copy of BROWN'S Jamaica, to examine his descriptions and figures of *Ilia punctata* and of *Guaia punctata*, referred to by M. EDWARDS.

† GUAIA ORNATA—Philadelphia Cabinet. This is a very distinct and pretty species of the genus *Guaia*, from Upper California, described by Dr. RANDALL as *Ilia ornata*, (J. A. N. S., vol. viii, p. 129,) but really belongs to the genus to which I have referred it. Probably, for want of specimens at hand really belonging to *Ilia*, Dr. R. overlooked its peculiar characters.

3. TRIBE CORYSTIANA.

ATELECYCLUS CRUENTAT[illegible], DESM.—New-York Cabinet.
ATELECYCLUS CHILENSIS, M EDW.—New-York Cabinet.

4. TRIBE DORIPPIANA.

DORIPPE LANATA, LAMK.—Boston Cabinet.
DORIPPE QUADRIDENTATA, LATR.—New-York Cabinet.
DORIPPE SIMA, M. EDW.—New-York and Charleston Cabinets.
CYMOPOLIA CARONII, ROUX—Boston and Charleston Cabinets.

B. ANOMOURA.

1. FAMILY APTERURA.

1. TRIBE DROMIANA.

DROMIA VULGARIS, M. EDW.—Boston and New-York Cabinets.
DROMIA LATOR, M. EDW.—Boston, Philadelphia and Charleston Cabinets. My specimen is *from Key West*.

2. TRIBE HOMO[illegible]

H[illegible] [illegible]ACH—New-Y[illegible] Cabinet

LITHODES ARTICA, LATR.—Boston Cabinet. The specimen was obtained on the *coast of Massachusetts.*

3. TRIBE RANINIANA.

RANINA DENTATA, LATR.—Philadelphia Cabinet. Two fine specimens. Dimensions of largest: shell 4 1-2 inches long and as many broad, shell with abdomen extended 7 inches; breadth of hand, finger excluded, 1 1-4 inch, finger included, 2 1-2 inches; length of thumb or moveable finger, 1 1-2 inch; length of one of the first pair of feet, thumb extended, is 7 inches.

RANILIA MURICATA, M. EDW.—Boston and Charleston Cabinets. The specimens were brought *from Florida* by Mr. BARTLETT. M. EDWARDS' description was drawn from a single specimen in bad condition in the Cabinet of the Museum of Natural History at Paris, and no figure of it has been given. I have a colored drawing of it made two or three years since, and hope to publish it with a description in the course of the year, in the Boston Journal of Natural History.

2. FAMILY PTERYGURA.

1. TRIBE HIPPIANA.

ALBUNEA SYMNISTA, FABR.—Boston, Philadelphia and Charleston Cabinets. My specimens are only fragments of the exuviæ of this species, found by me on the beach at Sullivan's Island, at entrance of *Charleston Harbour.* I cannot decide without specimens of the foreign species for comparison, whether this is new or not; the short description of M. EDWARDS and others, apply to it in nearly all particulars.

ALBUNEA SCUTELLATA, DESM.—Charleston Cabinet. Fragments from *Charleston Harbour.* The preceding remarks apply here also, but it is to be observed the country of this species is not given by DESMARESM and MILNE EDWARDS. I believe this is the first notice that has been given of the existence of these two species on this continent.

BLEPHARIPODA OCCIDENTALIS, RANDALL—Philadelphia Cabinet. A well marked genus; the individual is a female, abdomen with appendages, first pair of feet cheliform; hence near Albunea, but quite distinct.

REMIPES TESTUDINARIUS, LATR.—Boston Cabinet.

HIPPA EMERITA, LATR.—New-York and Charleston Cabinets. The specimens in these two Cabinets are from the coast of Brazil, and enable me to make a comparison with our own species.

HIPPA TALPOIDEA, SAY—Boston, N. York, Philadelphia and Charleston Cabinets. Since receiving the Brazilian specimens, I have not had an opportunity of again examining individuals *from the coast of Massachusetts and New-York*, but have little doubt that they agree with those in my Cabinet *from Charleston Harbour, and from Key West.* On comparing the Brazilian and Carolina specimens, the difference between them is obvious, though perhaps not easily conveyed in words, being one of degree, no absolute character presenting itself for distinguishing them. The chief points of difference are in the rostrum, form and size of the terminal segment of the first pair of feet, and of the third segment of the exterior jaw feet, and in the degree of serrature of the latero-anterior edge of the shell. In the *H. emerita*, the rostrum is acute and nearly as prominent as the adjacent teeth of the rostral sinus, in the *H. talpoidea*, it is rounded at tip, less prominent, sometimes almost obsolete in the first species, the terminal segment of the first pair of feet is oval or ovate, rounded at tip; in the second, narrower, more lanceolate, sometimes acute at tip. A similar difference exists in the third segment of the exterior jaw-feet, which is broad, and dilated posteriously in *H. emerita*, and is narrow and elongated in *H. talpoidea*; in the former, the serrature of the latero-anterior edges is minute, but very distinct; in the latter, it is indistinct or obsolete; also the spines on various parts are more robust and strongly marked in *H. emerita*, than in *H. talpoidea*, as the three spines, on the large basilar segment of the external antennæ, the spine on the fourth segment of first pair of feet, and the prolongation of the fifth. The Brazilian specimens, three in number, all females, with eggs, presented a complete agreement in their characters, as did also three out of four Carolina specimens, all four also females; the fourth, was more marked than the others, rostrum scarcely visible, last segment of the first pair of feet narrow and acutely pointed; third segment of jaw-feet, narrow, and tapering anteriorly.

2. TRIBE PAGURIANA.

PAGURUS BERNHARDUS, LATR.—Boston and Philadelphia Cabinets. This species has been found on the *coast of the eastern States*, and the specimens, I believe, are deposited in the Cabinet of the Boston Soc. Nat. Hist.

PAGARUS CALLIDUS, ROUX—Boston Cabinet.

PAGURUS PUNCTULATUS, OLIVIER—New-York and Philadelphia Cabinets.

PAGURUS GRANULATUS, OLIVIER—Boston, Philadelphia and Charleston Cabinets. My specimens are *from Key West.*

PAGURUS ANICULUS, OLIVIER—Philadelphia Cabinet.

PAGURUS VITTATUS, BOSC.—Charleston Cabinet. This species is very abundant in *Charleston Harbour.* I have it also *from Key West.*

PAGURUS POLLICARIS, SAY—Boston, New-York, Philadelphia and Charleston Cabinets. Enumerated among the Invertebrata of *Massachusetts* by Dr. GOULD; *coast of New-York,* Dr. DEKAY. My specimens are *from Charleston Harbour,* and I have them also *from Key West.*

PAGURUS LONGICARPUS, SAY—Boston, New-York and Charleston Cabinets. From *coast of Massachusetts,* Dr. GOULD; *coast of New-York,* Dr. DEKAY; rather common in *Charleston Harbour.*

PAGURUS CARINATUS, RANDALL—Philadelphia Cabinet.

PAGURUS SYMMETRICUS, RANDALL—Philadelphia Cabinet.

PAGURUS DECORUS, RANDALL—Philadelphia and Boston Cabinets.

PAGURUS LÆVIMANUS, RANDALL—Philadelphia Cabinet.

PAGURUS LATENS, RANDALL—Philadelphia Cabinet.

* PAGURUS TRICOLOR—Charleston Cabinet. Brought *from Key West* by Dr. WURDEMANN. Opthalmic ring without rostriforme process, ocular peduncles equal in length to the basilar portion of the external antennæ, and longer than their spiniform process, blue, cornea black, with white dots; rostrum reduced to a mere acute tooth, scarcely perceptible; anterior feet deep brown, spotted with white, tips of fingers black, carpus granulated and heiry; two following pairs of feet sky blue, annulated with orange at the upper part of each segment, just beneath articulation, tarsi yellow with brown spots, and an orange ring just beneath the articulation; external antennæ orange, first segment of internal antennæ blue, second blue beneath, orange above, tuft at the extremity orange; shell, blue, anterior portion subquadrilateral with four black spots; length of body and abdomen one inch.

CENOBITA DIOGENES, M. EDW.—Boston, Philadelphia and Charleston Cabinets. The specimens of the Charleston Cabinet are *from Key West.*

3. TRIBE PORCELLANIANA.

PORCELLANA CINCTIPES, RANDALL—Philadelphia Cabinet.

PORCELLANA PLATYCHELES, LAMK.—Charleston Cabinet.

PORCELLANA SOCIATA, SAY—Philadelphia and Charleston Cabinets. In the Philadelphia Cabinet is SAY's original specimen, collected on the coast of Georgia, without the label however. I have specimens *from the coast of S. Carolina* and *from Key West.* I have not been able to identify MILNE EDWARDS' *P. pilosa* with this species nor with any of the following; he says it is from the environs of "Charlestown," in the United States. Nor have I been more successful in identifying LEACH's *Pisidia Sayana*, (DESM. Consid. Gen. Crust., p. 199,) nor the *Porcellana galathina* of Bosc, either as described by himself with figure, (Hist. Nat. Crust. tom 1, p. 299, 2d edit.,) or by DESMAREST, (op. cit. p. 199.)

* PORCELLANA OCELLATA—Charleston Cabinet. *Coast of South-Carolina.* Front trifid, middle lobe most prominent, with central depression, in some individuals sub-acute, with sub-dentate edges, outer angle of the eye acute, but without spine, shell with a distinct border running backwards two-thirds its length; carpus short, with projecting lobe at base of inner edge, this edge without spines, outer edge with a slightly raised border, with a single spine at articulation with hand; hand sub-triangular, lower edge ciliate; shell smooth, without spines, with whitish spots, when recent, on a reddish ground, which is frequently deeper around the spots; posterior part of shell and abdomen with reddish longitudinal bands, hand and carpus of large claw marked like shell, feet with transverse reddish bands, in which the ocelli may be frequently perceived. All these markings are less distinct in the dry specimen.

* PORCELLANA ARMATA—Boston and Charleston Cabinets. *From Florida.* Front not trifid, middle portion prominent, lateral portions rounded; eyes prominent, outer angle of orbit obtuse, a little distance behind it, on the edge of the shell, an acute spine, from which an indistinct border runs back, carpus twice as long as broad, anterior edge with three acute teeth, posterior edge bordered with four or five small spines, hand sub-triangular, lower edge serrate, with small spines; third segment of the three following feet, with two or three spines on the upper edge, one at the anterior termination of the lower edge; shell brownish red in the dried specimen, rugulose with small transverse piliferous lines, these are apparent also on the feet, and more distinct on the carpus and hand where the lines are granulate.

* PORCELLATA SEXSPINOSA—Charleston Cabinet. Collected at *Key*

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West by Dr. WURDEMANN. Front not trifid, middle portion prominent, lateral portions rounded, very slightly prominent; on each side of the front, just over the eye, there is a spine forming, as it were the inner angle of the orbit, the outer angle of the orbit is also formed by a spine, short, but very distinct; behind which, at a little distance on the shell, there is another, from a marked ridge runs backward, forming a border to the shell, but before reaching the posterior edge, turns upward and forms one of the transverse lines on the back; basal joint of the external antennæ with a stout spine; carpus moderately long, with five broad teeth on the anterior edge, the last forming the angle at the articulation with the hand, outer edge with five or six small spines, hand sub-triangular, serrate and slightly ciliate on lower edge; shell covered with long transverse, distinct, piliferous lines, giving it a well marked rugous appearance, lines generally extending one-third the breadth of the shell; carpus and hand rugous in like manner on both surfaces, lines running entirely across the carpus; third segment of the legs clothed with similar rugæ, on the upper edge spinous. This I suppose to be the *Porcellana* observed by SAY, and considered by him *P. galathina*, (J. A. N. S., vol. 1, p. 458.)

* PORCELLANA MAGNIFICA—Charleston Cabinet. Brought from *Vera Cruz* by Dr. CLEVELAND, of Charleston. Front resembles that of the two preceding, not trifid, triangular, with a central linear depression; shell with length and breadth nearly equal, as in all the preceding, smooth, polished, punctate, with traces of rugæ near the lateral edges, which are marked with a moderately distinct line, no spines in any part, anterior feet unequal in size, carpus long, about three times as long as broad, and as long as the shell, anterior edge with three distant teeth, posterior marked with a few denticulations near the articulation with hand; hand broad, flat, thumb included sub-triangular, but the lower edge, or anterior edge when folded in repose, is regularly arched from the articulation round to the tip of the finger; palmar portion as long as the carpus; finger and thumb with their opposing edges straight, without teeth, slightly hooked at tip, surface of carpus and hand, shining, but roughened with a multitude of exceedingly minute granulations on the upper surface, on the lower, they are few and scattered, and the surface comparatively smooth and polished; color of shell and anterior feet pale red in dry specimen.

* PORCELLANA MACROCHELES—Charleston Cabinet. Found on the

coast of South-Carolina by Dr. T. L. BURDEN, of Charleston. Totally different in appearance from all the preceding. Body thick, shell transverse, length to breadth as three to four, convex longitudinally, front very slightly prominent, anterior edge nearly straight, eyes small, not prominent; basal segment of external antennæ massive, completely filling up the groove in the shell in which it is placed, and bearing only on its outer angle the moveable peduncle, which is thus entirely separated from the eye; the groove is not prolonged backwards under the lateral portion of the shell as usual, but that course is marked by a fissure; anterior feet unequal, third segment subcubical, rounded posteriorly, with a projecting lamellar lobe anteriorly; carpus as long as the shell, thick, subcylindrical, with anterior edge curved, lamellar projecting, without teeth or spines; the larger hand, long, thick, subcylindrical, anterior edge for three-fifths of its extent straight, ciliate, thumb falcate, acute, finger straight-hooked at tip, with a large tooth on the middle of the trenchant edge; smaller hand more slender and compressed; larger hand with the finger, is twice the length of shell; color pale yellowish white in dry specimen.

MONOLEPIS INERMIS, SAY—Charleston Cabinet. Obtained from the stomach of a fish (*Thynnus vulgaris*, CUV.?) taken at sea, *off the Atlantic coast*, on a voyage from New-York to Charleston, in 1846.

MONOLEPIS SPINITARSUS, SAY—Philadelphia Cabinet. The specimen described by SAY, with his label, *from the coast of South-Carolina.*

C. MACROURA.

1. FAMILY LORICATA.

1. TRIBE GALATHEANA.

GALATHEA STRIGOSA, DESM.—New-York Cabinet.

GALATHEA SQUAMIFERA, LEACH—Boston and Charleston Cabinets.

2. TRIBE SCYLLARIANA.

SCYLLARUS ARCTUS, FABR.—Boston, New York, Philadelphia and Charleston Cabinets.

SCYLLARUS LATUS, LATR.—New-York Cabinet.

SCYLLARUS SQUAMMOSUS, M. EDW.—Philadelphia Cabinet.

SCYLLARUS EQUINOXIALIS, FABR.—New-York, Philadelphia and Charleston Cabinets. My specimen is *from Key West*, sent by S. R. MALLORY, Esq.

THENUS ORIENTALIS, LEACH—Boston, New-York and Charleston Cabinets.

IBACUS ANTARCTICUS, LEACH—Philadelphia Cabinet, from Sandwich Islands, I believe.

IBACUS PARRÆ, M. EDW.—Philadelphia Cabinet. I insert under this name an individual in the Philadelphia Cabinet marked as "brought from Santa Cruz by R. E. GRIFFITH," but it agreed in character with the preceding species and with M. EDWARDS' description of it, the spine being *present* on the fifth pair of feet, the *absence* of which makes his *I. Parræ* a native of the Antilles. Are the two species really one? or is a closer comparison yet required of the analogous species of the Gulf of Mexico and of the Pacific?

* IBACHUS NOVEMDENTATUS—New-York Cabinet. I will, for the present, indicate under this name, an individual in the above mentioned Cabinet, which resembles *I. Peronii*, and I believe I so labelled it provisionally; but it is distinguished by the following characters: It has nine teeth on the lateral edges of the shell, instead of seven, that is, eight behind the lateral fissure of the shell, instead of six, as in *I. Peronii*, and one before the fissure, as in that species, forming the anterior angle of the shell; the last segment of the exterior antennæ have on their anterior edge six or seven teeth, instead of three or four, as in *I. Peronii;* of these six or seven, three are broad and prominent, the others small and intermediate; and, lastly, the fourth segment of the external jaw-feet is traversed by seven or eight deep fissures, not mentioned in M. EDWARDS' description of *I. Peronii*, but may exist, for it is proper to add that I have not seen a specimen really belonging to that species. DESMAREST, I find, mentions these fissures or deep grooves in his character of the genus, which, however, only includes *I. Peronii.*

3. TRIBE PALINURIANA.

PALINURUS VULGARIS, LATR.—Boston Cabinet.

PALINURUS AMERICANUS, M. EDW.—Boston, Philadelphia and Charleston Cabinets; also in American Museum, New-York. I have specimens *from Key West.*

PALINURUS INTERRUPTUS, RANDALL—Philadelphia Cabinet.

2. FAMILY FOSSORES.

CALLIANASSA MAJOR, SAY—New-York and Charleston Cabinets. My specimens are *from Coast of South-Carolina* and *Charleston Harbour*. With regard to SAY's description, it must be observed in applying, that he erroneously supposes the hand to be abnormally constituted and to be two-jointed; what he calls first joint of hand is really the carpus; his carpus is the third joint or segment, and so on. The crustacean described by Dr. DEKAY as *Gonodactylus setimanus* (op. cit., p. 34,) belongs to this genus, as can be seen from the description and figure, and I regard it as belonging to this species. Most probably the individual he obtained had lost the large anterior foot so striking in this genus, and the error was thus induced. But I have examined the specimen preserved in the New-York Cabinet with his label, and it does not belong to the *Stomapoda*, as the branchiæ are in the position usual in *Decapoda*, under the shell, and it is in fact a *Callianassa*. The necessity for this and other corrections I communicated to Dr. DEKAY, with the wish that he would himself make them public; he communicated them to the Lyceum of Natural History of New-York, but I cannot learn that they have been published. With the same motive I made a similar communication to Dr. RANDALL, but his distance from the specimens, and other engagements, induced him to entrust the office of correcting these errors to me. As Dr. RANDALL has made this request, and as Dr. DEKAY's corrections do not appear to have been published, I have inserted in this paper the corrections requisite in both cases, influenced by that friendly consideration for both gentlemen which a consciousness of one's own liability to error should ever induce for the errors of others.

* CALLIANASSA GRANDIMANA—Charleston Cabinet. This species was brought *from Key West* by Dr. F. WURDEMANN, and is easily distinguished from *C. major* by its large anterior claw or foot. The second segment is slender and narrow near its articulation with the first, and is dilated and incurved as it advances, with distant granules on its lower edge; the third segment is broader, dilated so as to form below a sharp serrated edge, which is truncated as it approaches the posterior articulation, inner surface of the segment is nearly plane, on the middle of the outer is a longitudinal obtuse ridge; the carpus

is united with the preceding segment by a small articulating surface near its upper edge, somewhat inflated externally, the breadth, or rather the depth, nearly twice as great as the length, the posterior lower angle rounded, forming an edge without any trace of serrature; the hand broader, or rather deeper, than the carpus, and its length, exclusive of the finger, is nearly double that of the carpus, inflated on the internal surface, and more so on the external, lower edge ciliate, and with a few small distant serrations; whole surface of hand, as well as of carpus, smooth and polished.

Gebia affinis, Say—Charleston Cabinet. *From Charleston Harbour.*

3. FAMILY ASTACIDÆ.

Astacus fluviatilis, Fabr.—Philadelphia Cabinet.

Astacus Bartonii, Fabr.—Boston, New-York, Philadelphia and Charleston Cabinets. Inhabits *Massachusetts*, Dr. Gould; *New-York*, Dr. DeKay; I have it *from New-Jersey*, from the upper part of *South-Carolina*, and *from Alabama.*

Astacus affinis, Say—Boston, New-York, Philadelphia and Charleston Cabinets. My specimens are *from Florida.*

Astacus Blandingii, Harlan—New-York, Philadelphia and Charleston Cabinets. My specimens are from the low country of *South-Carolina.*

Astacus pellucidus, Tellkampf—Boston and Charleston Cabinets. From the *Mammoth Cave, Kentucky.*

Homarus Americanus, M. Edw.—Boston and New-York Cabinets. From the coast of the *Northern States.*

Nephrops occidentalis, Randall—Philadelphia Cabinet. From west coast of North-America.

4. FAMILY PALEMONIDÆ.

1. TRIBE CRANGONIANA.

Crangon septemspinosus, Say—Boston, New-York and Charleston Cabinets. From the *coast of the Northern States* I think Say must be mistaken when he says (op. cit., p. 26,) that this species is found as far south as East Florida. I have never met with it at the South, and can scarcely believe that I have overlooked it.

Crangon cataphractus, M. Edw.—Boston Cabinet.

2. TRIBE ALPHEANA.

ATYOIDEA BISULCATA, RAND.—Philadelphia Cabinet. From Sandwich Islands.

ALPHEUS DISPAR, RAND.—Philadelphia Cabinet. From Manilla. Hardly distinct from *A. brevirostris*, M. EDW.

ALPHEUS LÆVIS, RAND.—Philadelphia Cabinet. From Sandwich Islands.

ALPHEUS HETEROCHELIS, SAY—Charleston Cabinet. *From Charleston Harbour* and *from Key West.* I am strongly induced to believe that the *A. armillatus* of M. EDWARDS is the same as this species; the "circular depression around the large hand," mentioned by him, among its characters, corresponds exactly with the "abrupt constriction near the fingers" in SAY's description.

ALPHEUS MINUS, SAY—Charleston Cabinet.—*From Charleston Harbour* and *from Key West.* SAY puts the specific name in the neuter gender.

* ALPHEUS FORMOSUS—Charleston Cabinet. Brought *from Key West*, with the two preceding, by Dr. WURDEMANN. Size of *A. heterochelis*, but readily distinguished from it by the rostrum and hand; rostrum large and well-formed, arising a little distance behind the edge of the shell by a broad base, and running forward to an acute point, projecting beyond the anterior edge of the shell, which it overhangs; a small spine on the vaulted part of the shell over each eye; hand smooth, moderately compressed, slightly contorted, without constriction or depression on the hand, and not presenting the deformed appearance of the hand in *A. heterochelis;* a single spine on the hand on the inside at the articulation of the thumb; *A. heterochelis* has no spines over the eyes; these are present in *A. minus*, but the rostrum which springs from the edge of the shell is scarcely larger than they, so that the anterior edge appears tridentate.

* PONTONIA DOMESTICA—Charleston Cabinet. Found on the *coast of South-Carolina*, inhabiting the living shells of *Pinna muricata* and *P. seminuda*, sometimes in company with *Pinnotheres maculatus.* Rostrum broad, depressed, projecting, acute, body stout, smooth, with a small spine on the outside of the insertion of the external antennæ; hand, excluding the finger, as long as the shell, inflated, but only about half the diameter of the body; finger broad, with two teeth, thumb slender, arched, with a single tooth fitting between the two on the finger when closed. This, I believe, is the first time this genus has been indicated as belonging to America.

3. TRIBE PALEMONIANA.

HIPPOLYTE MARMORATA, M. EDW.—Philadelphia Cabinet, Sandwich Islands.

HIPPOLYTE ACULEATA, M. EDW.—Charleston Cabinet. Taken by me from the stomach of a Cod or Haddock, on the *beach*, *at Lynn*, *Mass.*, brought in by fishermen.

HIPPOLYTE GRACILIPES, RAND.—Philadelphia Cabinet. The specimen so labelled was in bad condition, but certainly belonged to genus *Palemon*. Perhaps some interchange of labels had taken place.

*HIPPOLYTE WURDEMANNI—Charleston Cabinet. Brought *from Key West*, in 1845, by Dr. F. WURDEMANN. Found last year in *Charleston Harbour*, by JAMES JOHNSON, Esq., of Charleston. Rostrum springing from the middle of the shell, and running forwards to the base of the last segment of the peduncle of the internal antennæ, and to about two-thirds the length of the lamellar appendage of the external antennæ, with four teeth on its upper edge, (not including the spine at the tip,) and a fifth at the base, separated from the others by double interval, three or four teeth on lower edge, a spine on the anterior edge of the shell above the base of the external antennæ, feet of second pair slender, filiform, multiarculate, longest nearly twice the length of shell and rostrum together.

* HIPPOLYTE PALUDOSA.—Charleston Cabinet. Obtained a few years since, in fresh water ponds, in St. Andrew's Parish, South-Carolina, and presented to me by F. S. HOLMES, Esq. The specimens were not quite perfect, having lost some of their feet and antennæ. Rostrum springing from the anterior part of the shell, long, projecting beyond the peduncle of internal antennæ, and a little beyond the lamellar appendage of the external antennæ, six to seven teeth on upper edge, three on lower, a spine on edge of shell, over the base of the external antennæ. This I believe to be the first announcement of fresh water species of *Hippolyte* in the United States. MILNE EDWARDS appears to regard *Hippolyte* as masculine; it surely is feminine and I have so regarded it.

RHYNCHOCINETES TYPUS, M. EDW.—New-York Cabinet. A fine specimen of a remarkable genus of M. EDWARDS, very near *Hippolyte*, but with the rostrum articulated with the shell, and moveable.

PANDALUS ANNULICORNIS, LEACH—Charleston Cabinet. Taken by myself from the stomach of a Cod or Haddock, at *Lynn*, *Mass.*

Palemon serratus, Fabr.—Boston Cabinet.

Palemon squilla, Fabr.—Boston Cabinet.

Palemon locusta, Fabr.—Boston Cabinet.

Palemon vulgaris, Say—New-York and Charleston Cabinets. *Coast of Massachusetts*, Dr. Gould; *New-York*, Dr. DeKay; common *in Charleston Harbour;* on Coast of *Florida*, Say.

Palemon carcinus, Olivier—Boston, Philadelphia and Charleston Cabinets.

Palemon jamaicensis, Olivier—Boston and Charleston Cabinets. Also in American Museum in New-York. My specimens are from the Island of Cuba, brought by Dr. Wurdemann.

Palemon punctatus, Randall—Philadelphia Cabinet. Supposed to come from the East Indies.

Palemon spinimanus. M. Edw. Charleston Cabinet. Brought with *P. jamaicensis*, from Cuba, by Dr. Wurdemann.

Palemon gaudichaudii, M. Edw.—Philadelphia Cabinet. Two fine specimens of this species of M. Edwards, first brought from Chili by Gaudichaud.

Palemon grandimanus. Rand—Philadelphia Cabinet.

Palemon gracilimanus, Rand—Philadelphia Cabinet.

4. Tribe Penæana.

Sicyonia sculpta, M. Edw.—Boston Cabinet.

Penæus brasiliensis, Latr.—Charleston Cabinet. Under this name, I wish to indicate a species, which occasionally is met with on the *Coast of South-Carolina.* It agrees generally with M. Edwards' description of *P. caramote*,—having the rostrum running back to the posterior edge of the shell, with a sulcus on each side, continued equally far, and a third groove on the posterior part of the crest of the rostrum, also continued to the posterior edge of the shell—and I have sometimes so labelled it, but it has no spines on the base of the third pair of feet. My referring it to *P. brasiliensis*, Latr., is based on an assumption, it must be observed, that that species is Brazillian, and may occasionally visit our coast. I have not seen Latreille's description of it, and, therefore, cannot say that ours is new. Full grown individuals of this species are occasionally found in the shrimp trays in the market, containing the following species. Once in our market I saw a tray full of half grown individuals of this species.

PENÆUS SETIFERUS, M. EDW.—Boston, Philadelphia, and Charleston Cabinets. Abundant at certain seasons in *Charleston Harbour.* With the preceding known as Shrimps in our market.

STOMAPODA.

PHYLLOSOMA COMMUNIS, LEACH—New-York Cabinet.

PHYLLOSOMA STYLICORNIS, M. EDW.—New-York Cabinet. These specimens are the only representatives of this curious genus in our Cabinets.

SQUILLA MACULATA, FABR.—Philadelphia Cabinet.

SQUILLA VITTATA, M. EDW.—American Museum, New-York.

SQUILLA SCABRICAUDA, LATR.—Boston, New-York, and Charleston Cabinets. My specimen was presented to me by Dr. T. L. OGIER, of Charleston, to whom it had been brought by a fisherman, who had taken it *off Charleston Harbour.*

SQUILLA MANTIS, FABR.—Boston Cabinet. It is somewhat surprising that MILNE EDWARDS, in his description of this species, does not allude to the differences pointed out by SAY, between this species and his *S. empusa.* In this species, of the last four last thoracic segments, all but the last are bifurcate or bilobed at their exterior terminations, as it is tolerably well exhibited in the figure of HERBST, pl. 33. fig. 1; the anterior one, (or that just behind the large plate or shell of the animal,) is bifurcate, the two spines being in the same *horizontal plane* or one *anterior* to the other, and the two following segments are bilobate over the base of the feet. The lateral edges of the shell are not angulated, but rounded with tolerably uniform curvature. The figure in the Encycl. Method, pl. 295, fig. 1, is so coarsely executed, like several other figures in that work, that it can scarcely be regarded as an adequate representation; it exhibits, however, the two bilobate segments; the other figure, pl. 324, is of another species, *S. raphidea,* M. EDW., SEBA's fig. pl. 20, fig 2, is a better one. DESMAREST's figure of *S. mantis,* pl. 41, fig. 2, is referred to by MILNE EDWARDS in his description of that species, but it is really a figure of *S. scorpio,* LATR, described by him two pages beyond. The figures of DEGEER, pl. 34, fig. 1, and of LATREILLE, Hist. Crust., pl. 55, fig. 3, referred to by M. EDWARDS, I have not seen.

SQUILLA NEPA, LATR.—Philadelphia Cabinet. Also in the American Museum, New-York.

SQUILLA EMPUSA, SAY—Boston, New-York, Philadelphia and

Charleston Cabinets. This species is quite distinct from *S. mantis*, as was pointed out by SAY. Of the four last thoracic segments, the most anterior, or one just behind the shell, is bifurcate, but the two spines are in the same *vertical plane*, or one *above* the other, when the animal is in the usual position for locomotion, and the two following segments are not bilobate. *S. dubia*, M. EDW., and *S. Desmarestii*, RISSO, have a similar conformation. Dr. DEKAY, (op. cit. p. 33) does not allude to these characters, which distinguish it from *S. mantis*, though he insists on the distinctness of the two species. In this species there is also an obtuse angle on the lateral edges of the shell, which is wanting in *S. mantis*. Found on the *Coast of Rhode Island*, according to SAY; *New-York*, DE KAY; frequently taken in *Charleston Harbour*, whence my specimens are derived; *Coast of East Florida*, SAY.

* SQUILLA NEGLECTA—Charleston Cabinet. Obtained in *Charleston Harbour*. This new species resembles in many points, *S. empusa*, but is readily distinguished by the following characters. The thoracic segment just behind the shell is bifurcate, as in that species, with one spine above the other, but the uppermost is not narrowed gradually to an acutely pointed termination, bat its two edges are parallel, and the extremity is rounded, so that it is spatuliform and not spiniform, the median crest of the last abdominal segment terminates posteriorly in an acute spine, twice as long as in the preceding species.

SQUILLA DUBIA, M. EDW.—Boston and Charleston Cabinets. My specimens were obtained *in Charleston Harbour*, but it appears to be rare. Readily distinguished from *S. empusa*, by there being only four or five denticulations between the large terminal teeth of the last abdominal segment, and three or four between these teeth and the next large ones; as in *S. mantis*, there are six teeth to the claws. A good idea of this species may be obtained from DESMAREST's figure, of *S. mantis*, pl. 41, fig. 2, which, I feel confident, was drawn from a specimen of *S. scorpio*, LATR., a species closely allied to this; only four teeth, however, instead of five, on the claws, are distinctly indicated in the figure.

SQUILLA DESMARESTII, RISSO.—Boston Cabinet.

SQUILLA STYLIFERA, LAM.——Philadelphia and Charleston Cabinets.

SQUILLA CERISII, ROUX. New-York and Philadelphia Cabinets.

Gonodactylus chiragrus, Latr.—Boston, Philadelphia, and Charleston Cabinets. My specimens are *from Key West.*

Gonodactylus scyllarus, Latr.—Boston Cabinet.

Gonodactylus styliferus, M. Edw.—Philadelphia Cabinet.

The preceding enumeration contains 250 species, of which 22 are described as new. Of those enumerated, 94 belong to the Atlantic Coast of the United States, of which 19 are new, and 10 more, though already described, yet were not distinctly recognized as belonging to our Fauna. The species of Podolphthalmian Crustacea, known to belong to our Fauna, but not embraced in the above enumeration, are *Pilumnus Harrisii*, Gould; *Pinnotheres cylindricum*, Say; *P. depressum*, Say, *Porcellana pilosa*, M. Edw., *Crangon boreas*, Fabr., and *Mysis spinulosus*, Leach, giving 100 species to our Fauna.

There are several undetermined, and in some cases, most probably undescribed forms, both native and foreign, in my Cabinet, as also in the others, but the want of works of reference, and particularly want of specimens, deter me from describing at present. I have made several attempts to obtain correspondents on the coast of the northern States, and in Florida and Cuba, as also in Europe, for exchange of specimens, but so far without success.

On the Morphological Difference of Organs, by Prof. Agassiz.

[Not received.]

Meteorological and Mortuary Chart of New-Orleans, for 1849, *by* Dr. E. H. Barton, *of New-Orleans.*

A Report on this Chart was given by Prof. Leconte, to whom it had been referred, accompanied by remarks on the importance and difficulties of Mortuary Statistics.

Observations on the Geology of Ashley River, South-Carolina; by F. S. Holmes, Esq., *of Charleston, S. C.*

The first exposure of the Eocene Marl, so extensively developed on Ashley River, occurs one mile below Ashley Ferry, and about six miles in a direct line North-West of Charleston. The estimated thickness of this bed, called by Mr. Ruffin, "the great Carolina Marl Bed," is about eight hundred feet, as determined in boring the

Artesian well in Charleston; and by the same means we have ascertained that the underlying beds are cretaceous.

The porous beds of the Buhr-stone or lowest Eocene, from which was expected a supply of water, are found to have "thinned out" before reaching the city, and thus were we disappointed of our hopes, and must penetrate to a greater depth in or below the Cretaceous in search of a water-bearing stratum.

In ascending the river, the marl is seen gradually rising, until at Bacon's bridge, the head of navigation, it attains the height of eight feet above the level of the tide. The surface of the bed is quite irregular, with numerous circular depressions, from one to four feet deep: which are filled with detrital matter, containing many fossils from the superimposed beds.

Rich as the marl is in the remains of Foraminiferæ of many genera, and of the most gigantic size, it nevertheless is very poor in fossils of the larger forms of molluscous animals; Gryphea mutabilis, Anomia jugosa, and a few others only, are to be had in a perfect state, though the whole bed abounds in casts of various species.

Of the remains of marine vertebrata, it has been pronounced by Prof. Agassiz, who accompanied me on a visit to the most interesting localities on the river, to be "the greatest cemetery he ever saw." I have myself collected from it many thousand specimens of the teeth of Squalidæ, and I am confident thirty thousand of such specimens have been taken from it within the last six years. Prior to the visit of Prof. Agassiz, a few specimens only of the remains of quadrupeds had been found upon the Ashley. This was owing to the fact that the collectors of these fossils were searching in the Marl, and not in the overlying beds; but we can now number no less than twenty-two or three species in my own cabinet and those of two friends.

These fossils were at first supposed to belong to the Marl bed or Eocene formation, but subsequent investigations show that they do not, and I will now proceed to point out their true position in the sequence.

The Miocene and Pliocene formations are missing upon the banks of the Ashley, that is to say, we have as yet found no fossils characteristic of these beds, but between the Post-Pliocene and the Marl, in the position in which the Pliocene should be found, we have two or three strata, containing fossils which make them exceedingly interesting to the geologist, and which are not found in the Eocene Marl bed below.

The first of these is a thin, irregular stratum of loose gravelly sand, which lies immediately upon the marl, and which seldom exceeds eight inches in thickness.* From the number of fish teeth and bones found in this sand, Professor TUOMEY called it the "*Ashley fish-bed.*" Above, and in a manner mixed with it, is another of irregular and partly rolled fragments of what is commonly called *marl-rock*—the interstices between each being filled with blue mud. These rocks contain the same forms of fossils as are found in the marl below; but the lime which they must have contained has been extracted, leaving a silicious mass much water-worn and boulder-like in appearance, and emitting a fœtid odor when broken. The Marl of the Ashley contains about 70 per cent. of carbonate of lime—these only a small quantity, say 2 or 3 per cent.

That they belong to and were broken off the Marl bed below, there can be no doubt, but at what period they were washed up and deposited where we now find them, is still undetermined. They extend over many miles of the surrounding country; increase in size towards the north-west, and decrease in the opposite course, south-west, where we find them under the city of Charleston.

For the most part, they are enveloped, as I said, in a matrix of blue mud or clay, though often a peaty substance (query, marsh roots?) takes the place of the clay, and again the clay and peat are missing, and they are found in the sand.

Next in the order of super-position are the red clay, yellow sands and alluvium of the country; the Post-Pliocene, like the Miocene in other parts of the State, is only found in patches; its geological position is under the red clay.

In the strata of sand, marl-rock, blue mud and peat, just described, we find the following fossils: Bones and teeth of Mastodon, Megatherium, Dinotherium, Elephant, Deer, Horse, Cow, Hog, Muskrat, etc. etc., mixed up with the remains of marine animals; but in the Marl not a single fragment of a Mammalian has yet been discovered, except cetacean. If ever a specimen has been taken from the Marl, it was near its surface—perhaps from some hole or depression so shallow as to escape the notice of the finder, and there can be no doubt that in this manner several Naturalists have been deceived in supposing these fossils to have come out of the true Eocene Marl.

* In boring the Artesian Well in Charleston, this stratum was reached at about sixty feet below the surface, and from it a supply of good water is obtained; the water rises within four feet of the surface.

I am convinced they belong to a more recent formation, and we must await further investigation ere we attempt a determination of the ages of these beds.

I herewith submit groups of fossils from the different beds to the examination of the Association.

PROF. AGASSIZ remarked on the importance of the paper read in Palæontology, in showing so large a number of mammalia, there having been more genera found in the fossil beds of South-Carolina, than there are now living on the whole Coast of the United States.

A recess of fiften minutes was taken at 1 o'clock, and after the recess business was resumed, Prof. TUOMEY in the Chair.

Rev. Dr. BACHMAN'S work on the Unity of the Human Race, was presented in his name to the Association.

The following paper, was presented by Prof. SHEPARD, to whom it had been referred,

On some results relating to the Proximate Composition of the different parts of the flowers of several plants, and of the plants themselves, and on the Inorganic Matter in Gums and Gum-Resins; by J. H. SALISBURY, M.D., *of Albany, New-York.*

HORSE CHESTNUT (Æsculus hippocastanum,) May 18th; plant in full bloom.

Percentage of Water, Dry Matter and Ash in the									
	Pistils and ovaries.	Stamens.	Petals.	Sepals, receptacles and pedicles.	Peduncles.	Leaf blades.	Young twigs and petioles.	Bark of limbs two inches in diameter.	Wood of limbs two inches in diameter.
Percentage of water, - -	70.697	83.419	85.045	84.527	87.047	79.485	84.730	5[illegible].5[illegible]0	48.0[illegible]0
Do. dry matter, -	29.3[illegible]3	16.581	14.9[illegible]5	15.473	12.953	20.515	15.270	46.[illegible]00	51.970
Do. Ash, - - -	2.423	0.96	0.821	1.471	1.313	1.58[illegible]	1.1[illegible]0	4.290	0.550
Do. Ash cal. on the dry mat.	8.269	5.821	5.487	9.504	10.133	7.746	7.2[illegible]9	9.226	1.[illegible]16

Parts mentioned in the order of the inorganic matter which they contain, commencing with the highest.

Peduncles—Ash calculated on the dry matter,		.	10.133
Sepals, receptacles and pedicels,	"	.	9.504
Bark of limbs,	"	.	9.226
Pistils and ovaries,	"	.	8.269

Leaf blades—Ash calculated on the dry matter,	.	7.746
Young twigs and petioles, "	.	7.269
Stamens, "	.	5.821
Petals, "	.	5.487
Wood of limbs, "	-	1.116

Results obtained from several parts of the Horse Chestnut plant, May 4th, before the flower buds began to show themselves; leaves from two to three inches long; imbricated scales of buds not yet fallen off.

Percentage of Water, Dry Matter and Ash in the

	Imbricated scales of buds coated with wax.	Leaf blades.	Young twigs and petioles, 2 to 3 inches long.	Bark from limbs 2 inches in diameter.	Wood from limbs 2 inches in diameter.
Percentage of water, -	80.000	79.408	88.987	51.000	56.130
Do. dry matter,	20.000	20.592	11.013	49.000	43.870
Do. ash	1.852	1.838	1.271	5.000	0.510
Do. Ash cal. on dry mat.	9.359	8.927	12.479	10.204	1.162

The foregoing results show an evident decrease in the percentage of inorganic matter in several parts of the plant, from May 4th to to May 18th.

Tiger lily (Lilium tigrinum) in the early stage of flowering, before the petals were fairly unfolded; July 20th.

Percentage of Water, Dry Matter and Ash in the

	Pistels.	Ovaries.	Anthers.	Filaments of stamens.	Petals.
Percentage of water, - - - - -	89.091	82.612	34.965	90.674	86.815
Do. dry matter, - - - -	10.909	17.388	65.035	9.326	13.185
Do. ash, - - - - - -	0.909	1.248	6.993	0.481	0.611
Do. Ash calc. on dry matter, - -	8.333	7.182	10.752	5.152	5.118

Tiger lily in the advanced stage of flowering; petals falling; August 3d.

Percentage relation of the several parts of the flower to each other.

Percentage of	anthers, - - - - -	7.029
Do.	pistils, - - - - -	2.872
Do.	ovaries, - - - - -	2.315
Do.	filaments of stamens, - -	15.174
Do.	petals, - - - - -	72.610
		100.

Percentage of Water, Dry Matter and Ash in the	Pistils.	Ovaries.	Anthers.	Filaments of stamens.	Petals.	Stalks.	Leaves.
Percentage of water, -	90.210	85.00	80.27	89.680	88.180	76.380	82.150
Do. dry matter,	9.790	15.00	19.73	10.140	11.820	23.620	17.850
Do. ash, - -	0.680	0.890	1.46	0.750	0.650	0.500	1.900
Do. ash cal. on dry mat.,	6.945	5.935	7.399	7.396	5.500	2.116	10.644

It is interesting to notice the decrease of inorganic matter in the pistils, ovaries and anthers of the tiger lily, from July 20th to August 3d, while during the same period there is a corresponding increase of ash in the petals and filaments of the stamens.

Pæony, (Pæonia officinalis,) double red; in flower; petals just ready to fall; July 1st.

Percentage of Water, Dry Matter and Ash in the	Pistels and ovaries.	Receptacles.	Petals.	Sepals.	Leaves.	Stalks.
Percentage of water, - - -	68.14	69.44	77.022	63.75	69.000	57.30
Do. dry matter, - - -	31.86	30.56	22.978	36.25	31.000	82.70
Do. ash, - - - - - -	1.38	1.68	1.111	2.75	3.060	1.70
Do. ash cal. on the dry mat'er,	4.331	5.497	4.835	7.586	9.871	2.055

Inorganic Matter in Gums and Gum Resins; by J. H. Salisbury, MD.

Percentage of Water, Dry Matter and Ash in	Plum tree gum.	Gum arabic.	Gum tragacanth.	Kino.
Percentage of water, - - - - -	3.792	12.350	8.155	11.850
Do. dry matter, - - - - -	96.208	87.450	91.845	88.150
Do. ash, - - - - - -	3.453	2.750	2.155	0.225
Do. ash calc. on the dry matter, -	3.589	3.137	2.346	0.255

Composition of Inorganic Matter in						
	Plum tree gum.	Gum arabic.	Gum tragacanth.	Gum myrrh.	Olibanum or Frankincense.	Kino.
Silica, - -	1.200	0.65	15.25	8.05	1.50	16.30
Phosphate of Lime, " Magnesia,	1.678	4.20	15.40	7.25	5.70	20.40
" Iron, -	0.022	0.95	0.15	0.35	0.30	1.90
Lime, - -	30.066	34.88	26.70	26.47	40.94	8.38
Magnesia, - -	4.900	3.16	3.30	16.42	6.84	14.54
Potash, - -	47.422	17.25	8.27	7.48	1.50	12.26
Soda, - -	0.950	21.64	9.93	11.10	10.32	9.96
Sulphuric Acid, -	6.530	0.60	0.60	0.91	trace	6.20
Chlorine, - -	0.553	0.42	0.42	1.17	1.20	2.90
Carbonic Acid, -	6.590	16.75	20.65	19.78	31.76	6.92
Organic Acids, -	trace	trace	trace	trace	trace	trace
	99.911	100.50	100.67	98.98	100.06	99.76

The specimens of gum used in the foregoing results, were the purest that could be obtained. They seemed to be entirely free from foreign matter. The carbonic acid is formed during the combustion. In the resins, the inorganic bases are probably in the form of pinates, silvates, phosphates, sulphates and chlorides.

Prof. AGASSIZ read a paper—

On the Structure of the Halcyonoid Polÿpi; by Prof. AGASSIZ.

AFTER removing the so-called Hydroid Polypi from the class of Polypi, to place them among Medusæ, and the Bryozoa being referred to their true natural position among Mollusca, the class of Polypi, contains only two natural groups of animals, the Actinoid Polypi, and the Halcyonoid Polypi.

Having, on a former occasion, given an account of my investigations, of the former group, I will now proceed to make some remarks upon the Halcynoid Polypi of the United States, which I have had an opportunity to examine. They belong to three different genera.

Renilla.

One of these genera is the well known *Renilla reniformis*, which is extremely abundant on the Southern shores of the United States.

Though this genus is already well characterized, I have made upon it some remarks which may not be without interest.

Like the other genera of the family of Pennatuloid Polyps, they have a soft distinct axis, with a terminal kidney-shaped flat disk, spreading horizontally upon the vertical stem, so that its plane is at right angles with the stem, though the two halves are symmetrical upon the longitudinal diameter of the upper part of the axis. The axis, and also the disk, are hollow, and their cavities communicate freely with each other. In their expanded state, these cavities are filled with water by means of which they swell to a very remarkable extent, so much so that the disk may be enlarged to twice its diameter, and the peduncle of the stem to four times its height in an expanded state, when compared with its utmost state of contraction. When expanded, the stem stands upright, sunk in sand, its lowest extremity swollen into an oblong bulb, somewhat compressed laterally. The middle part of the stem is more cylindrical; but in its upper part, it again enlarges into a sort of funnel, compressed laterally, extending with its prominent diameter, under the lower surface of the disk. The disk itself, is kidney or heart shaped, thicker in the middle, when swollen, and growing thinner towards the edges. Its lower surface is smooth at the stem, but there is a sort of radiation observed upon it, extending from the summit of the stem towards the margin, and corresponding to the linear radiating arrangement of the isolated animals, upon the upper surface of the disk. There are no polypi arising either from the stem, or from the lower surface of the disk; they all arise from the upper surface and edge. The isolated polypi arise from a softer area, in the form of octagonal tubes, elongated more or less when expanded, and terminating with a crown of eight lobed tentacles. These tentacles are arranged symmetrically upon the sides of an oblong oral aperture, three on each side of the mouth, and one in advance, and one behind; so that notwithstanding the apparent uniformity of the tentacles, there is a slight indication of bilateral symmetry in their arrangement, particularly marked by the oblong form of the opening of the mouth. The whole body is purplish red, of a very vivid color; the lowest extremity of the stem only is more yellowish, as is also the prominent angle of the funnel under the disk. The polypi themselves are bluish white, of a very delicate transparent appearance, lightly dotted with brown specks, forming a ring under the crown of tentacles, and two brown stripes upon the upper surface of each tentacle near the edges, broader toward the mouth, and tapering between the lobes of the

tentacles. The cavity of these individual animals is divided into eight partitions, by longitudinal folds of their walls, and to these folds the digestive cavity is adherent above, but it opens free into the main cavity of the buds, in its lower part. There is no division, no partition at the bottom of the individual polypi, so that the food which has been digested in the upper alimentary sack, as soon as it is emptied into the main tube of each polyp, passes into the main cavity of the disk, and is circulated, not only in that cavity, but also within the main cavity of the stem. The water, also, which distends the whole body, is introduced through the mouth of the individual polyps, and expelled through the same aperture when the body contracts. This animal has a very remarkable phosphoresence. It shines at night with a golden green light of a most wonderful softness. When excited, it flashes up more intensely, and when suddenly immersed into alcohol, throws out the most brilliant light. The stem has no solid support at all, as is the case with several other genera of the same family, but there calcareous spiculæ arranged in a radiating manner in the disk, and a few clusters of them at the base, and at the summit of the body, of each individual animal, situated in the spaces corresponding to the intervals between the lobed tentacles.

I have collected hundreds of specimens of this species upon the beaches of Sullivan's Island, in the bay of Charleston, South-Carolina, and also on the beaches south of Savannah, in Georgia, upon Warsaw Island.

Halcyonium.

The genus Halcyonium is usually spelled Alcyonyum, but this is incorrect.

I am not aware that any species of this genus has as yet been noticed upon the shores of the United States. In August, 1847, I dredged, however, a very handsome specimen, off Cape Cod, belonging to this type. It was attached to a loose shell of Mytilus Modiolus, upon the concave side of the shell, and seemed to differ from the known species of that genus, in having a proportionally small body, from which rose a cluster of long tubular individual polypi, each of which was nearly as long as the greatest diameter of the common base, from which they arose. When fully expanded, the individual polypi were tubular, cylindrical, slightly contracted under the tentacles, which spread in the form of an octagonal star, the lobes stretch-

ing slightly outside, and somewhat arched and downward. The form of each tentacle was conical, with a rounded tip; the lobes of the margin were proportionally not very deep; the odd terminal lobe larger than the lateral ones, the relative size of which was gradually less from the tip of the tentacles to its base. The mouth was slightly oblong, without folds, and below it hangs a cylindrical main digestive cavity extending for about one-fourth of the whole length in the expanded state of the tube, but occupying nearly one half of its length when distended by food in the contracted state of the animal.

The main cavity of the body is subdivided by eight prominent folds into as many imperfect partitions, shut from each other in the region of the stomach by their adherence to its outer surface. The substance of the body is rather consistent. The main bulk, from which the individual polypi arise is especially tough, being supported by numerous calcareous spiculæ, spread irregularly through its mass; but even the individual polypi are of tough substance, less moveable than those of Renilla, and expanding and contracting very slowly, while the polypi of Renilla are rather active. In consequence of this toughness of the substance, it was rather difficult to ascertain the internal arrangement of the parts, and to trace the circulation within the main cavity. I could however, satisfy myself that there are four ovarian bunches hanging from the inner projecting margin of the lateral folds, projecting into the cavity below the stomach; and a few eggs were still suspended to those bunches, which consisted of curled threads, coiled irregularly into four bunches. Besides these, there were two other threads hanging more loosely from two other partitions, which, probably were spermatic cords, though I could not detect any spermatic cells in connection with them. But the difference in the aspect of these threads, when contrasted with those from which the eggs hang, will scarcely leave any doubt as to their real nature. The fluid contained in the main cavity circulates regularly up and down between the partitions, and the currents extend into the tentacles and follow up the sinuosities of their lobes to the summit of the tentacles, returning in the opposite direction.

The movements of the individual polyps are regulated by bundles of contractile fibres extending along the partitions in the main wall of the body. These bundles are attached above and below to clusters of calcareous spiculæ, which are arranged in a regular order in the form of prominent cords within the outer wall of each partition,

and upon the outer wall of each tentacle, at its base. These spiculæ the microscopic stems of a ragged appearance, formed, probably, by the reunion of a number of calcareous crystals developed in distinct cells, and united together in a somewhat regular manner, so as to form longitudinal stems with irregular projections upon their surface. Numbers of these little stems converge, in two parallel rows with their tips towards the tip of the tentacles, and others from the base assume a similar arrangement, and form larger cones around the base of the tube of the animal.

The point of insertion of the contractile fibres is in the narrow angles between those clusters, and they rise from the base of the tube upwards to the base of the tentacles, thus extending over the whole length of that part of the tube which is most contractile and retractile.

It remains to be seen whether the specimen of this animal which fell into my hands was quite full grown; for it is possible that the cluster observed was the beginning of a larger body, to be formed by the addition of a greater number of individual polypi growing out of the common base.

Should it be found, upon further investigation, that this type is a permanent combination, and that the stalk never grows to a bulky mass, and that the polypi arising from it are always proportionally so much larger than the stem itself, it may constitute a generic type intermediate between Halcyonum proper and Renilla. I have, at least, never seen the individual polyps disappear entirely under the surface of the body, as we know to be the case among the true fleshy Halcyoniums.

For the distinction of the species, I shall propose the name of *Halcyonium carneum*, designating its flesh-color, and also the greater softness of the bulk when compared with the ordinary Halcyoniums.

Gorgonia.

The third genus of the Halcyonoid Polypi which occurs along the shores of the Southern States is the genus Gorgonia, with its many species about the Florida Keys, one of which is very common as far north as the Carolinas. Of this species I have had repeatedly an opportunity to examine living specimens with their expanded animals. The genus is well characterized by having a horny solid stem attached by a spreading base to solid bodies at the bottom of the sea.

The species vary greatly in the manner in which this stem branches and in the combination of these branches into a spreading shrub-like growth, with distinct branches or fan-like flat expansions and anastomosing branches. Although there seems to be no regularity in the distribution of the individual polyps upon the main stem, there is, nevertheless, one circumstance which should not be lost sight of, and requires further investigation fully to appreciate its meaning. It will be observed, indeed, that upon one side of the stem there is a deep furrow following the direction of the branches, as well as that of the main stem, and so assigning a peculiar character to one side of the branches. But how this furrow is formed I have not been able to ascertain. No polyp rises from its depression, nor even from its margin. They uniformly spring up from the plain surface of the branches in the shape of short tubes expanding into eight, lobed, rounded tentacles, supported at their base by calcareous spiculæ. The mouth is so regular as not to afford the means of distinguishing the longitudinal axis.

Even without taking into consideration the various modes in which the individual polyps are combined to form a regular kidney-shaped disk, as in Remilla, or an irregular spreading body, as in Halcyonium, or a branching stalk, as in Gorgonia, we find in the structure of the individual polypi differences which sufficiently characterize these genera in the form of their tentacles. In Renilla the isolated tentacles are elongated and lobed only towards their extremity and upon part of their sides. In Halcyonium the tentacles are triangular and the longer lobe is terminal, while in Gorgonia the tentacles are rounded and the lobes more uniform. The species of Gorgonia which I have examined is *Gorgonia virgulata*. The numerous varieties which occur in Charleston Harbour should induce some Naturalist to enter upon a very minute investigation of the structure and development of that species, in order fully to ascertain what are the changes which it undergoes with age, and what are the natural limits of the species in this genus; for the species are so numerous, and they all seem to vary so much, that until a complete monographic investigation of one species has been made, it will be impossible to determine with precision foreign species which have not been observed carefully in a fresh state.

The variations of color which occur in this species are very remarkable. I have seen specimens growing together, and undoubtedly belonging to the same species, which were light yellow, and

almost white, passing into a dark yellow tint; others light orange; others dark orange; then light purple varieties; others almost pink, or bluish purple, and some perfectly white as pure chalk. It is really a wonderful sight to behold these varieties growing together in clear water and spreading over considerable surfaces with all these colors mingled. From the same stone specimens will arise of all these different hues. At times stems of one color will grow from the bore of stems of other colors; but I have never been able to discover a branch of another color upon the same stem, or the stems of different colors arising from the same base. Wherever this seems to be the case, upon close examination it is always found that the parts differing in color have distinct origins, although they may grow upon each other, as they all grow upon stones or other sub-marine bodies.

Although it may be difficult to raise eggs and see the whole process of development, it is so very easy to collect a series of specimens in all stages of growth, from their first appearance in the shape of minute buds upon the surface from which layer specimens arise, that, for a persevering observer on the spot there will be no difficulty in tracing the whole range of the metamorphoses. I would only mention what an examination of a few days has enabled me to observe, that the new stems sprout in the form of stiff, erect, simple stems; that more advanced specimens show a simple bifurcation, which will successively give rise to a greater number of branches. At first, the young polypi have only a narrow base of attachment, and we find only in larger ones that the stem spreads into a wide flat base, by which it is attached to the ground. The mode of development of this base might also be easily ascertained by a series of specimens carefully collected for that purpose, and placed side by side, to see the changes in the development. It is to be hoped that some intelligent young naturalist at the South will supply the deficiency of these observations, gathered during a hurried excursion.

Whether this species occurs in other parts of the ocean beyond the limits of the United States, is a point which I am unable to determine. It may be that the indications of other localities in which *Gorgonia virgulata* is said to occur are either incorrect or have reference to closely allied representative species growing in other parts of the world.

The reading of the papers being now finished, Prof. Bache resumed the Chair, and read the following report of the Standing Committee.

There will be a meeting of the Standing Committee on Monday next, at 9 A. M.

The following gentlemen are nominated for membership—Rev. JOHN FORREST, EDWARD MANIGAULT, Esq., JOHN M'RAE, Esq., JAS. RHETT, Esq., of Charleston, S. C. They were unanimously elected.

Resolved, That the thanks of the Association be tendered to the Commissioners of Public Buildings of the State of South-Carolina, for the use of the Hall of Meeting and Committee Rooms, and to the President and Members of the South-Carolina Society, for the use of their Hall, for the evening of Friday.

Resolved, That the thanks of the Association be tendered further, to the citizens of Charleston, for the elegant hospitalities which they have extended to the Association.

These Resolutions were proposed to the Association and carried, warmly seconded by Lieut. MAURY in an address, brief, but full of feeling.

The following communication from the Mayor of the city, was then read by the President:

To the Officers of the American Association
for the Advancement of Science:

YOU are authorized to state that the Corporation of Charleston claims the privilege of assuming all expenses attendant upon the meeting of the Scientific Association in this city.

T. LEGER HUTCHINSON, MAYOR.

March 16th, 1850.

And these resolutions of the Standing Committee announced:

Resolved, That the warmest thanks of the American Association for the Advancement of Science, are tendered to the Corporation of ths city of Charleston, for their distinguished liberality to the Association.

Resolved, That especial thanks are due to the Mayor, for the terms in which he has made the announcement of the intention of the Corporation.

Dr. A. A. GOULD, of Boston, rose to second these resolutions. He remarked that South-Carolina was among the first in scientific inquiry, few States having preceded her in such efforts, and the names of Carolina Naturalists are among the earliest he remembered to have

read. In Science, South-Carolina has stood almost alone in the South. The origin and existence of this Association may be traced to the Scientific views of the South. Local State Geological surveys, were first proposed in the South, if not in South-Carolina, although Massachusetts was the first to carry them into effect. These surveys induced Geologists to form an Association for comparing notes and connecting their observations, and of that Association the one now holding its meeting is the result.

But a new and important movement now originates in Charleston. No civil authority, of any description, has in any previous instance come forward, unsolicited, to sustain a voluntary Association for Scientific purposes; Charleston has not only *volunteered*, but claimed the *privilege* of so doing. This augurs well for the future prospects of Science in this country.

He was happy to have something from the North to unite with this liberality of the South. A valuable volume of the transactions of the Association was published a few years since, principally at the expense of one of its most devoted members, the lamented Dr. AMOS BINNEY, of Boston. The undistributed portion of the volumes is now the property of his lady, who is at present a visitor in this city, and requests that copies of the volume be offered to any members who may signify a desire for it.

Prof. AGASSIZ said, that he felt more than ever the value of these meetings, not only in the advancement of Science, but in effecting interchanges of civilities, in bringing about reconciliations, and in the promotion of kindly feelings among men. These results had an important bearing, not merely on the members of the Association, but on the different sections of the Union represented in the meetings. However widely conflicting political and commercial views might tend to separate the States, the ties of Science would ever remain as bonds of Union.

The resolutions were proposed to the meeting and unanimously carried.

The President, Prof. A. D. BACHE, after a few remarks on the general harmony that had marked the intercourse of the members, the valuable character of the papers presented, and the successful course of the whole proceedings, pronounced the meeting adjourned.

LEWIS R. GIBBES, *Secretary*.

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